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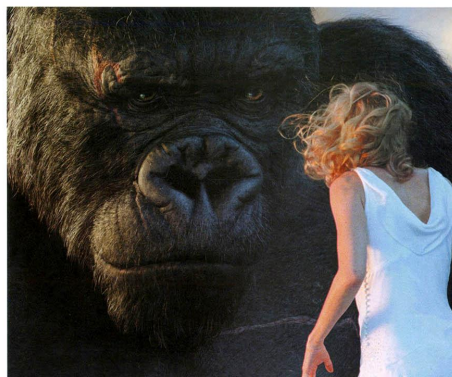
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Overview

Kent Houston on *The Legend of Zorro*

article by Jody Duncan

Before there was *Batman* or *Superman*, there was Zorro. The alter ego of a wealthy 19th-century dandy, Don Diego de la Vega, Zorro was a force of good for the common man, donning a black mask and taking up sword to fight the enemies of Spanish California's early settlers. Introduced in 1919, in a short story, "The Curse of Capistrano," by Johnston McCulley, Zorro quickly became an iconic figure, immortalized in a silent film, *The Mark of Zorro*, just one year later, and providing subject matter for numerable movies and television shows in subsequent decades.

Director Martin Campbell put a somewhat lighthearted spin on the legend in his 1998 feature, *The Mask of Zorro*, which starred Antonio Banderas as Alejandro Murrieta — a bandit mentored by de la Vega to become the new Zorro — and Catherine Zeta-Jones as his feisty love interest, Elena Montero.

In Campbell's sequel, *The Legend of Zorro*, Elena is now Alejandro's dissatisfied wife, weary of her husband's nocturnal escapades. To save his marriage, Alejandro lays down his sword and mask — but must take them up again to ensure California's impending statehood and to save his wife and son from the clutches of the ruthless Count Armand (Rufus Sewell).

The climactic rescue scene takes place on a speeding train. Live-action elements were shot on a real 19th-century train in central Mexico, but much of the sequence was a postproduction creation overseen by production visual effects supervisor Kent Houston — who had supervised the effects for Campbell's *Vertical Limit*, *Beyond Borders* and a number of the director's commercials — and executed on three continents by effects crews from Digiscope, Peerless Camera Company and Weta Workshop.

The train rescue, which would constitute about half of the show's overall 550 effects shots, started off as a modest sequence, but grew throughout production. "Eventually," Houston remarked, "it became much bigger and much more complicated than anybody had planned. Initially, they weren't sure that they could afford it, or that they could even pull it off. But we worked our way through it, and figured out what we needed to do for each part of it."

The sequence begins with Zorro's attempting to catch up to the speeding train, riding his horse along a ridge high above the tracks, then jumping the steed onto a train car rooftop as he reaches the end of the bluff. Production's initial plan was to shoot a real rider and horse making the eight-



foot jump onto a stationary car-roof mockup. “The idea was that we would shoot the horse jumping from a mocked-up cliff top we’d built and surrounded with bluescreen onto this dummy train carriage, and then track that to the real train to create a shot of Zorro jumping from the cliff to the moving train below. We were promised that a horse could actually do this jump; but, when we got there, the horse just would not do it. They rehearsed and rehearsed; but, generally, what the horse would do is stop, get down on its belly, and slide down onto the train roof — which, of course, didn’t look impressive at all!” As an alternative, digital effects supervisor Paul Docherty and his crew at Peerless created the shot digitally. “We had scanned the horse in Mexico, and we had scanned Zorro, and Peerless used those scans to create a CG horse and Zorro. The movement of the train carriage also became different than what we had shot elements for, and so that ended up being a CG train, as well.”



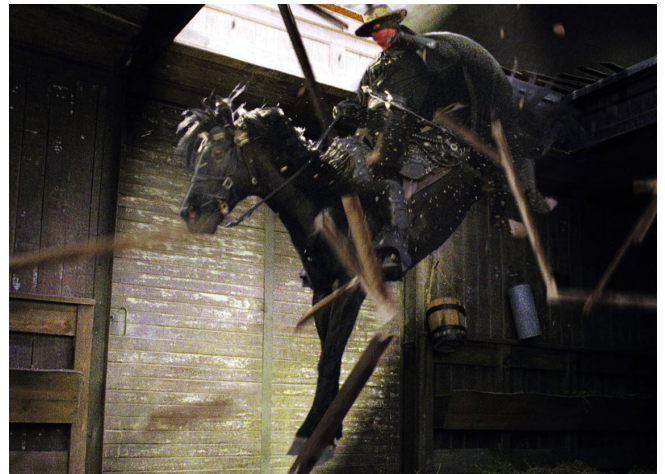
In The Legend of Zorro – director Martin Campbell’s sequel to his 1998 The Mask of Zorro– the 19th-century sword-wielding hero executes a daring rescue of his wife and son aboard a locomotive steaming through the California desert. For shots of Zorro and his steed galloping atop the moving train, production effects crews, led by visual effects supervisor Kent Houston, shot horse and rider on a ground-level stationary train roof mockup, surrounded by bluescreen. Peerless Camera Company tracked those bluescreen elements to live train footage shot in Mexico and to a miniature train and landscape built by Weta Workshop.

After Peerless' initial wide profile view of the CG horse and rider jumping onto the CG train, the camera cuts to a low-angle shot of the real horse landing on the stationary train roof mockup. "That was safe for the horse, because it was a shorter jump and the mockup was only about four feet above the ground. We shot it either against bluescreen or sky, blowing smoke across it so that it looked as if it was moving. It was on tires, so we could give it a bit of movement just by rocking it manually."

The scene continues with Zorro astride his horse, galloping toward the rear of the train to avoid being knocked off by an approaching tunnel portal. Horse and rider were shot galloping across the stationary roof set piece, and that element was tracked to a 1/5-scale miniature that was built and shot by Weta Workshop. The miniature included the train, tracks, tunnel and a large surrounding landscape that was carefully matched to the environment in the Mexico plates. "The most difficult part of it was matching the odd red color of the dirt in Mexico. Weta had people work in day in and day out, mixing dyes to get just the right color in the earth."

The action briefly moves inside the train when Zorro and his mount break through the wooden rooftop slats of a cattle car. Digiscope digital effects supervisor Dion Hatch and his crew assembled the shot, using a combination of live-action elements and CG. "You see him start to jump from above, and then the camera cuts inside the cattle car and you see him coming down through the slats. That was a bluescreen element of the horse jumping. It looks as if he is jumping about eight feet, but it was really only a four-foot jump, and we augmented the distance through CG. The wooden slats that break as Zorro and the horse jump through were also CG."

A stuntman performed Zorro doing a somersault off the rearing horse, rolling out through the hole in the cattle car roof. "Zorro lands on the roof and starts making his way down to the carriage where Elena is being held captive by Armand. He jumps through a skylight to get to her, which was a stunt guy on wires jumping through a carriage set piece." Live-action for the fight inside the train car was shot on a set built on a bluescreen stage in Mexico. Postproduction crews added plates shot from a train in Mexico to the bluescreen set windows to create views of the desert landscape rushing by.



Digiscope assembled live and CG elements to create a composite shot of Zorro and his mount entering the train's interior, breaking through the slatted roof of a cattle car. Effects crews shot a bluescreen element of horse and rider jumping off a four-foot platform, which Digiscope artists altered digitally to make the leap appear twice as high. Digiscope then integrated that bluescreen footage into plate photography of an open-roofed cattle car set, adding CG slats and debris.

Stuntmen performed live stunts on the moving train for subsequent wide shots of Armand and Zorro fighting on the locomotive's cow-catcher, while, for closer shots, Banderas and Sewell fought on a static cow-catcher mockup, shot handheld against bluescreen with smoke pumped out of the stack to simulate movement. The bluescreen footage was integrated with shots of the real train captured in central Mexico. "We were shooting the plates for this at the same time that we were shooting the bluescreen foreground action. It was very complicated, because the real train was about 50 miles away from where we were shooting the bluescreen. So we would shoot the bluescreen masters, and then send the camera data by satellite phone or by couriers in Jeeps to get the information to the live-action crew, 50 miles away. Then they would shoot the plates, based on this data from our bluescreen stage. If the courier got there with video of the bluescreen masters on time, they would do live comps with the train, as they were shooting. We had to emulate all the handheld movements on the bluescreen shots in these plates, which added another level of difficulty."

When the sequence was restructured in editing, long after production had wrapped, some additional shots of Zorro in combat with Armand were deemed necessary. To create the additional nine shots, Houston and his crew motion captured two stunt doubles at Blur Studios in Venice, California. "Because the sequence already had been cut, we knew exactly what choreography we needed, and we just motion captured them doing those specific actions. Then DigiScope built and animated digital doubles of Armand and Zorro, using that motion capture and scans of the actors, and composited them into the front of the moving train."

The postproduction restructuring also required additional work on wide shots of the train, which, due to a story point in which Elena releases two of the train cars to keep her son out of harm's way, would be seen with either two cars or four at different stages of the sequence. "We wound up with shots where the masters had two carriages and should have had four, or had four and should have had two. That resulted in a lot of very difficult work for us, removing carriages that shouldn't have been there, and restoring backgrounds, as well as adding CG cars to reconstruct the train."

The visual effects crew also had to remove flatbed camera cars and a diesel engine attached to the real train, which, as a vintage 19th-century museum piece, was incapable of moving under its own power. "All of those things had to be removed in these shots, and the backgrounds restored. We also had decided to use real smoke on the train, and there were a number of shots where the smoke was drifting across things we had to remove, which made those shots more difficult. On top of that, the location in Mexico had three parallel train tracks, but we wanted only one in the movie. We did our best to cover the additional tracks with foliage and earth on the day of shooting, but we could only do a small amount of that; and so there was a great deal



At the end of the sequence, the runaway train erupts in a giant explosion. Weta Workshop created the blast shots practically, rigging its detailed train model with miniature pyrotechnics and shooting it high-speed. Weta's setup included period-accurate locomotive and train cars, tracks, tunnel mouth, and a surrounding landscape that was very carefully matched to the production plates shot in Mexico. DigiScope added skies and distant mountains to the miniature photography.

of postproduction track removal.” Peerless and Digiscope shared train car and track removal and background restoration chores.

The train sequence ends with Armand collared to the cow-catcher and Zorro anchoring his whip to an approaching water tower to swing himself and Elena off the speeding locomotive just before it reaches the end of the line and explodes. The scene combined live-action stunt elements with an exploding train effect achieved on the Weta miniature.

Many of the show’s remaining 250-plus effects shots were for purposes of location enhancement, transforming Mexico’s central plains into a coastal environment. “Much of the movie is supposed to take place close to the ocean, and there are a number of shots in which you see ocean that wasn’t actually there. Peerless did quite a few matte paintings to get those ocean views, because we didn’t have time in the schedule to go and shoot plates. We also did a lot of effects shots aimed at correcting plates that had been shot in all different weather conditions. There was a lot of that basic, hard work for *The Legend of Zorro*. Those kinds of shots aren’t big, fancy things, and they pass by without notice — but they can be extremely difficult.”

The Legend of Zorro photographs copyright © 2005 by Columbia Pictures.

Overview

Pete Kozachik on *Corpse Bride*

article by Joe Fordham

In nineteenth-century Russia, the anti-Semitic murders of women en route to their wedding ceremonies inspired a gruesome and heartrending folk tale about a young groom who, while practicing his vows in the woods, playfully slips his wedding band onto what he believes to be a twig and accidentally revives the corpse of a murdered woman buried in her wedding dress, thereby pledging himself in marriage to her.

The morbid subject matter and bittersweet sentiments of the fairytale appeared tailor-made to the sensibilities of filmmaker Tim Burton, echoing themes explored in *Beetlejuice* and *Edward Scissorhands*. The story first captured Burton's attention while he was completing postproduction of his and Henry Selick's 1993 stop-motion musical *Tim Burton's The Nightmare Before Christmas* and, more than ten years later, came to fruition as another stop-motion feature, *Tim Burton's Corpse Bride*. The Warner Brothers project reunited some of the earlier film's key creative personnel, including producer Allison Abbate, screenwriter Caroline Thompson, and Pete Kozachik, who served as director of photography and visual effects supervisor on both *Nightmare* and *Corpse Bride*.

Burton shared the director credit on *Corpse Bride* with Mike Johnson, a stop-motion animator on *Nightmare* who had gone on to direct commercials and episodes of Vinton Studios' stop-motion television series *The P.J.s*. Vinton Studios remained production partners on *Corpse Bride* as Laika Entertainment, while Johnson guided the project through a lengthy preproduction and an intense 54-week shoot with Kozachik, art director Nelson Lowry and a handful of stateside animators who joined a European crew located within easy access to Burton's current residence in England.

Production was based at Three Mills Studios, a renovated seventeenth-century riverfront gin mill in London's East End, filling three soundstages with sets and a fourth building with the art department and fabrication department. In the early weeks of preproduction, production designer Alex McDowell worked with Burton, Johnson and their teams to create conceptual art, laying out the look of the characters and the worlds they inhabited, and inspiring the lighting design. "The design phase was all about colors," Pete Kozachik observed, "and creating a sense of place, period and atmosphere. It was a little west of Eastern Europe, more along the lines of a Dickensian world. The whole idea of the show was that the mortal characters inhabit a very bleak and monochromatic world; meanwhile, the only people who really know how to live are those who have finished living. The land of the undead was much more colorful, with lots of greens and violets. Lights were often



emanating from below or from weird places, so we wanted to steer clear of orange, yellow and red, which would have made it look like *Dante's Inferno* — not a fun place to live. We avoided hellfire colors and made it feel more like a fun house.”

While storyboarding was underway, Kozachik explored technology he had first considered for his previous stop-motion feature. “When setting up for *Monkeybone* in the late ‘90s, I tried to find a way to avoid shooting animation elements on film. Digital cameras that could do the job were too expensive back then, but products improved at a rapid rate soon thereafter, and I studied the new technology in the industrial realm. I thought we could shoot *Corpse Bride* digitally, but I wasn’t getting very far on selling the notion. When we were a few weeks away from filming, though, the combined support of Warner executive Chris deFaria and Allison, our producer, enabled us to do some testing. Warner lent us visual effects supervisor Chris Watts to provide an invaluable depth of knowledge on arcane subjects like digital color space. In a hurried process of elimination, we selected a particular model camera that was the best compromise for our needs and was mostly ready to go, and we started to shoot.”



Victor Van Dort and his *Corpse Bride* address the denizens of a colorful underworld of deceased characters, realized via stop-motion puppets in Tim Burton’s *Corpse Bride*. The London-based project reunited several key creative team members from Burton’s earlier stop-motion projects, including co-director Mike Johnson and visual effects supervisor and director of photography Pete Kozachik, who made use of modified digital still cameras to shoot the puppet stars and sets, with additional visual effects provided by The Moving Picture Company.

Kozachik and Watts chose a digital still camera — the Canon EOS-1D Mark II single lens reflex, modified to use Nikon lenses. “Canon lenses had a lubricated slip ring between what the operator was touching and what was going on in the inside, so we couldn’t grab the lens to pull focus. The aperture also opened and closed every time the camera shot a frame and did not close down the exact same amount every time. So we adapted Nikon lenses that we’d purchased to use with film cameras. That gave us more control. Andy Bowman, our camera and motion control tech, built special focus-pulling equipment and matte boxes that fit the Canon mounting, plus a whole laundry list of little electronic bits and bobs to help interface between the Kuper motion control and the camera.”

The modified EOS-1D was marginally bigger than a mechanical SLR and proved popular with animators for the ease with which it fit into miniature sets and for the dexterity of its performance, assisted by video tap. “SLRs can only see when they are shooting a frame, so Andy mounted fairly sensitive little black-and-white video cameras right up to the eyepiece, which gave us a view of the ground glass. We could have had color, but the animators preferred black-and-white because resolution was better and the lines were crisper. The ground glass of an SLR covered about twice the real estate of a 35mm movie camera, and that really made a difference. The optics were about 70 years better than what we would have had in a Mitchell.”

At the height of production, Kozachik's crew had 32 cameras operating simultaneously, each capable of storing 100 frames per one-gigabyte memory card, with images able to be viewed minutes after exposure. "Initially we'd shoot a frame, and look at it in Photoshop. That was a temp fix to get shooting; but the process eventually became more sophisticated, using Cineon files and special lookup tables to get monitor images to look almost exactly like eventual film outputs would. Film has about 100 years on digital and there is a built-in comfort factor in such a mature technology. You don't get that benefit entering a new technology, but the tradeoff we got into digital for was to shave time off our stage work, in lighting, dressing and time waiting on the lab — and it did that in spades."

While cameras were being developed, the puppet creation process proceeded with Tim Burton's distinctive concept sketches and fleshed-out character designs by Carlos Gragnel. "Sculptures evolved a bit from Tim's sketches. Sometimes we had to make the ankles a little fatter so the characters could stand up, but they never lost the original flavor. One look at those faces and you knew where they came from!" Mackinnon and Saunders, puppet-manufacturing specialists in Manchester, generated all the puppet armatures, skins and costumes for the film. Puppets were a little taller than the standard 10-inch height employed on previous productions. "Puppet size was driven by the size of the heads, which housed some exquisitely engineered mechanics. Some of the characters had only plug-in mouths, but most had a silicone skinned foam latex mask placed over a little skull with mechanics that made the lips move and the face smile and frown — all controlled through access points near their ears and the tops of their heads. Part of the reason we did that was we didn't think we'd have enough time to make replacement heads. So we went for broke by building these mechanical versions, and never looked back. We were nervous about doing that until we saw our first tests of facial animation with lip-sync dialogue. That was a good day."

Mackinnon and Saunders generated 12 principal characters and a host of ancillary puppets for the 100-member cast, and created duplicates and replacement parts resulting in a final count of close to 400 puppets. Durability of puppet skins varied with the animators, one skin in some cases lasting for one shot, others for an entire sequence; but in all cases the combination of silicone and foam rubber lasted longer than traditional foam latex alone, which tended to rot. To provide the constant puppet maintenance, fabrication supervisor Graham Maiden supervised a dozen artists who ran a puppet hospital at Three Mills for the duration of the shoot.



Animator Phil Dale attends to the Corpse Bride and a gathering of underworld inhabitants. The production based puppet scale on the size of puppet heads, which housed mechanical armatures that animators accessed through the puppets' ears and the tops of their heads. Puppet manufacturers Mackinnon and Saunders created 12 main characters and a host of ancillary characters for the 100-member cast, with duplicates and replacement parts resulting in a final count of close to 400 puppets. Art director Nelson Lowry scaled environments to puppet size, using elevated sets to allow for under-floor access.



Animator Chris Titchbourne animates a horse and carriage through a bleak mortal-world setting. For camera angles too expansive to incorporate practical backdrops, the production hung miniature environments with greenscreen. The Moving Picture Company then composited digital matte paintings and occasionally blended 3D set extensions with miniature and puppet elements. All mortal settings were designed with a drab monochrome colorpalette, contrasting the vibrant greens and violets representing the Burton-esque funhouse world of the dead.



Animator Brian Demoskoff adjusts the Corpse Bride's digits while an overhead armature supports her diaphanous bridal veil. The veil contained a tracery of wires that held their shape and, attached to armature rigs via fishing line, allowed animators to animate the garment to flow and waft in-camera. For selected scenes, MPC generated the veil digitally.

Nelson Lowry oversaw creation of miniature sets and props. The largest sets included an elaborate model of a town square, elevated 40 inches for under-floor access, which covered an area of 30 by 40 feet, backed by scenic paintings. Buildings — mostly 1/5-scale — were built to half height, then topped off, where required, with digital extensions. To open up the scope of the film, digital matte paintings were created by Lowry in Photoshop. For aerial establishing shots, a smaller-scale town square was composited with full scale set pieces and Lowry's digital matte paintings.

While motion control allowed multiple exposures and in-camera motion blur effects — created by moving camera or puppets during an exposure — effects requiring multiple elements were shot separately, and then combined in postproduction by The Motion Picture Company in London. MPC visual effects super visor Jessica Norman and CG supervisor Peter Muyzers handled digital enhancements and composites for approximately 450 shots. Environment composites included wide shots of a broad expanse of country side beyond the town — where the spindly hero Victor Van Dort (voiced by Johnny Depp) crosses a bridge to the mansion home of his fiancée, Victoria Everglot (Emily Watson) — created as a photo-montage of min-i ature, puppet and painted backdrop elements.

After a disastrous wedding rehearsal, Victor retreats to a forest, where he makes his fateful acquaintance with the *Corpse Bride* (Helena Bonham Carter). Effects of the Bride bursting from the ground, emerging through a ground mist, were created using physical elements, manipulated by MPC. “We did the animation first and treated it as a guide for where to put the mist. The mist was created quite simply one Saturday afternoon, shot on film. We set up some dry ice vapor on black velvet and coaxed it into doing what we wanted it to do. For the dirt falling off of the *Corpse Bride*, we dropped little white stones against black velvet covering a large-scale maquette of the *Corpse Bride*.”

Detailed puppet animation in the scene included eye animation, as Victor's pupils constrict with fear , achieved by placing various sizes of pupils onto the puppet's blank eyeball, adhered by glycerin so ani mators could slide pupils around from frame to frame. As Victor reels in fright, his hair flops and sways with a heavily-pomaded look, animated using a sculpted puppet hairpiece, cast in silicone-covered latex with wire-armatured clumps of hair, coated with a shiny surface to keep it looking wet.

The Bride's diaphanous veil, which flows and wafts around her, was also animated in-camera for a majority of the scenes. “The veil was veined with wires that held their shape. In many shots animators held the veil with fishing line, very thin wires, or an armature above that looked something like a robotic spider with lots of jointed legs coming down, so they could animate it



The production used larger-scale puppets to represent smaller characters, articulated against bluescreen, which MPC composited into scenes. Animator Tim Allen attends to a maggot sidekick that resides in the Corpse Bride's eye socket.

externally.” For certain scenes, MPC generated the veil digitally. “We used the digital veil for some glory shots, like the wide shot of the Bride when she approaches Victor on the bridge and when she’s dancing in the forest. It was a mix. Often it had to do with not having time to animate the veil on set.”

Practical and digital techniques combined for a spectacular shot of the Bride first embracing Victor, the camera spinning around the waltzing couple. “The camera was not really going around the puppets. When we finished shooting wides of the large bridge set, we figured how much bridge we’d see in the rotation shot, cut everything else away and built a motion control rig that could spin the set and key light. We animated the puppets and moved the camera in as the set rotated, backed by greenscreen. MPC extracted data from the motion control, turned one of Nelson’s matte paintings into a cylinder and spun that behind the characters.”

Victor is transported to the Bride’s underworld domain and encounters a Beetlejuice-style catalog of deceased characters — including an impaled diminutive Napoleon, a disembodied head transported by beetles, a vertically bifurcated cadaver and a chorus of skeletons choreographed in an expressionistic cabaret. “We shot the skeletons occasionally against black as eye-candy relief to all the detail. We had four or five variations of skeletons. They had regular mechanical armature parts, and if you look closely you’ll see little practical armature joints that don’t really belong in human anatomy, painted bone color.” MPC assisted with skeleton rig removal and layered animated elements as a skeleton with a derby hat, named Bone Jangles (composer Danny Elfman), performs a ‘scat’ solo in front of footlights and his shadow transforms into two other characters. “We shot the action simultaneously from the main camera and a second camera off to the side, with a greenscreen background. MPC created shadows from the side camera’s matte and cast them on the wall. It served as something the flat art animator could easily transition in and out of.”

The *Corpse Bride* reunites Victor with the remains of his deceased dog, a cheerful canine skeleton by the name of Scraps, which assembles from a jumble of bones animated using digitally erased external rigging. The *Corpse Bride* comes equipped with her own creature companions, including a green maggot that lives behind her eyeball and a black widow spider, both animated as oversize puppets for closeups. To animate crows that hover around the *Corpse Bride*, the production intermingled puppet animation for close up crows and digital crows for flocking scenes, generated by MPC.

Another airborne character is seen in the opening sequence, when Victor raises a bell jar to release a brilliant blue butterfly, the only source of color in his drab existence. “The butterfly was an animated puppet. It was large, about as big as your hand, and composited separately. We used that in some shots



Conveyed to the underworld, Victor encounters a chorus of lively skeletons that performs a cabaret in one of the film’s five musical numbers. Animator Antony Elworthy

where we had a single butterfly performance.” The butterfly reappears in the closing scene, taking on new significance as the *Corpse Bride* relinquishes her claim on Victor, leaving the mortal world in a flurry of flapping wings. “The cloud of butterflies was digital. MPC did a beautiful job of copying the shades and colors of our puppets. I found that MPC really took a pride of authorship in integrating their work with ours, aligning their work with the look and feel of the show. They always found a way to fit elements into a shot to make them work perfectly.”

Ultimately, Tim Burton’s decision to shoot *Corpse Bride* as a stop-motion feature was an artistic one — but the technique was particularly well suited to the subject matter, as well. “Tim frequently stated how much he appreciated the hand-hewn look of stop-motion. You either like that, or you don’t; but I am really glad he went with it, because it fit. *Corpse Bride* doesn’t feature chase scenes or big effects or comedy slapstick. The task at hand was all about motivating audiences to care about these little rubber critters up on the screen. It was an exercise in subtlety, respecting the medium and respecting the characters as if they were real, because they carried the story.”

Tim Burton’s Corpse Bride photographs copyright © 2005 by Warner Brothers Entertainment.

positions an assortment of skeleton characters featuring distinctive skulls and mechanical armature joints incorporated into their anatomies. Bonejangles, the scat-singing leader of the skeleton troupe, welcomes Victor to the show. Victor’s expressive facial animation was achieved by adjusting internal head mechanisms to manipulate silicone-skinned foam latex attached to the tiny skull.

Overview

Michael Shelton on *The Exorcism of Emily Rose*

article by Jody Duncan

Based on a true story about a priest implicated in the death of a young woman who claimed to be possessed by demons, *The Exorcism of Emily Rose* featured digital makeup effects by Keith Vanderlaan's Captive Audience Productions. Visual effects supervisor Michael Shelton had contributed digital applications for the scourging sequence in *The Passion of the Christ*, a project that marked the beginning of Captive Audience's transformation from creature and makeup effects facility to a one-stop shop that could realize first-rate digital effects, as well.



Director Scott Derrickson embraced the digital makeup approach, and gave Vanderlaan, Shelton and the Captive Audience team uncommon freedom in designing those effects. "Scott was convinced we could pull off the digital makeups on this show because of the work we'd done on *The Passion*," Shelton stated. "He was completely comfortable with the idea of doing digital makeup effects." Though live-action shots of a battered Emily, played by Jennifer Carpenter, were achieved with physical makeups — applied on the set in Vancouver, where production was based — all of the shots of her demonic apparitions, as well as the more extreme physical manifestations of the girl's possession were achieved digitally.

After a traumatic episode in her college dorm room — an experience she believes to be possession by an evil spirit — Emily begins to hallucinate the people around her transforming into screaming demons. In a five-minute sequence that Captive Audience dubbed 'the gauntlet of terror,' a succession of these ghastly-faced apparitions appear to her: first in a class, then on the campus grounds, and finally at the university chapel where the girl goes to seek spiritual protection. "Because these hallucinations happen one right after another, we wanted each of them to be distinct. We also wanted to build the sequence, with each subsequent apparition worse than the one before it."

At the time the initial classroom hallucination scene was shot, the nature of that specific effect had yet to be determined. To give the Captive Audience crew flexibility in post, Derrickson shot the actor portraying a demonic classmate very simply, a locked-off camera capturing the equally still performer opening his mouth to scream. "Since there was so little movement in the shot, we had to come up with something interesting; and eventually, we hit on the idea of his eyes filling with a kind of black goo, which would then pour down his face. It was a creepy effect, but it wasn't the full-

on demonic face we would see in later shots.” Once Captive Audience received the plate, digital artists warped the actor’s mouth to open it wider, and built digital eyes that were essentially containers that could be filled to overflowing with black fluid. “The goo flowing down his face was particle simulation that just followed a path that we warped and distorted so that it looked as if it was following the contours of his face. We modeled some very simple geometry to rest on his face and simulate those contours.”



Director Scott Derrickson sought subtle visual effects for The Exorcism of Emily Rose, an eerie drama based on the real-life case of a young woman who, believing she has been possessed by a demonic spirit, undergoes an exorcism that leads to her death. Keith Vanderlaan’s Captive Audience Productions, under the visual effects supervision of Michael Shelton, employed digital makeup techniques to portray Emily’s demonic visions.

Running out of the school building, Emily encounters a couple walking under an umbrella on the rainy campus grounds. As they pass, their eyes roll back in their heads, and their faces take on a demonic appearance. “The actors were walking towards a locked-off camera, and there wasn’t a perspective shift — so that ruled out the need for any kind of 3D head tracking. Animator Rob Ostir painted little matte paintings to make the eyes go white and make the skin look as if it was disintegrating, and then he tracked those elements using Shake. He used the warper in Shake to open the mouths and dissolve from the plate to the final image.”

The last gauntlet of terror image occurs when Emily runs into the chapel, where two middle-aged women are praying in the pews. As the women turn towards her, their faces transform into yet another horrific image. “They have a milky white membrane over their eyes, and the teeth on the woman to the right grow up into her face and split her lip. We did a lot of veining on her head, as well as distortion on her bone structure. We did that to the woman on the left, as well, but concentrated more on displacing her mouth and eyebrows. As soon as I saw the actresses playing the women on set, I knew that they would give us something great to work with. The other effects happened on college students, and they were all very young and fresh-faced. These women were older and had these terrific character faces to start with.”

To create the effect, Captive Audience modelers built 3D geometry replicating the women’s heads, and tracked that geometry to the actresses in the live-action plate. The 3D approach was required due to the women’s movement in the shot. “We had to have a 3D head that we could track. I also wanted the freedom to bring the effect up at any point as they turned their heads toward camera, rather than waiting for them to face camera fully and just do a 2D effect. So we had this 3D geometry, which we rigged to do basic movements. And then we made little digital makeup appliances, brought that geometry into ZBrush and created displacements and things like that. We took that back into Maya and used a ramp shader to bring the effect up and cause certain parts of the geometry to swell or sink in. I played around with that until I got something that looked interesting.”



In a five-minute sequence dubbed ‘ the gauntlet of terror,’ Emily experiences a number of startling hallucinations in which people around her transform into demonic entities. For the horrific transformation of two middle-aged women at prayer inside a chapel, Captive Audience created distorted versions of the women’s heads as animated 3D geometry, then tracked that geometry to the live-action plate photography. Other ‘gauntlet’ shots, featuring limited camera movement, were achieved through 2D digital manipulations of the live-action photography.

As the last hallucination in the series, the church ladies apparition had to be more extreme than those preceding it, yet not violate the restrained design aesthetic Derrickson had established for the film. “Scott made it clear that he didn’t want the kinds of over-the-top apparitions you saw in *Constantine*. Those effects were amazing, but they were seen within a very different world than this one. So I wanted to take this effect as far as I could, but without breaking that design aesthetic.”

In addition to showing respect for the film’s true-story roots, restrained horror effects supported Derrickson’s intentional ambiguity regarding Emily’s condition. The movie never resolves, one way or the other, whether the girl was really possessed or merely suffering from a severe form of epilepsy. Ambiguity also demanded that Emily’s horrific body contortions, displayed during ‘fits’ of possession, had to remain in the realm of human physiology. There would be no 360-degree head spins, such as the one memorably executed by Regan MacNeil in *The Exorcist*. “Scott’s direction to us for these shots was that they should be disturbing — but pushed no more than 10 percent beyond what a real body could do. Jennifer Carpenter came to our facility about a month before principal photography started, and rehearsed a lot of these contorted actions so that we could see what her body could do on its own, without any effects. Then we went from there.”

The chapel is the setting for one of the early contortion shots, in which Emily bends back at a sharp 90-degree angle at the waist, her spine nearly parallel to the floor. “Our mechanical department built a rig to support Jennifer’s back, so we could get an on-set plate. She was strapped into this thing, and it supported her weight so that she could bend back at the waist to a certain degree. Then we took that plate and basically cut up her image and repositioned parts of her body to make it look more horrific. We replaced parts of her real body with matte-painted pieces, painting out what was actually there and restoring the backgrounds where needed. We had shot clean plates to use for that purpose for a lot of these types of shots, but there was so much handheld camera work, we had to rebuild the backgrounds in the plates from scratch. In this shot, we also had to rebuild the cloth of the nightgown she was wearing, making it buckle at the appropriate spots when she was in this more extreme position.”

As filming progressed, Carpenter became more limber, able to assume ever more grotesque poses. Captive Audience had built a contorted Emily puppet for a shot in the girl’s dorm room, for example, intending to track the actress’ face to the dummy in post. But Carpenter’s increasing agility made the puppet unnecessary. “When it came time to shoot the plates, we put the puppet down on the floor, and had her get in the same position — or as close to it as possible — so that we’d be able to line her up to the puppet in the final shot. But when we found that she was able to line up her body very closely to the puppet and get into this horrible position, we thought, ‘Why not just shoot her?’ So we did that, then cut up the plate and repositioned her limbs,



The Captive Audience team also employed digital techniques to suggest physical contortions brought on by Emily’s possession. In the chapel, Emily (Jennifer Carpenter) bends back at a sharp angle, her spine nearly parallel to the floor. Captive Audience built a rig to support Carpenter’s back on set, enabling her to bend as far backwards as was physically possible. Captive Audience then cut and repositioned the image in the plate to create an unnatural pose, replacing some areas of her

twisting them a little bit. We did use the puppet in some reverse shots; but when you see her on the floor, that was all her, with our digital manipulation to her body parts.”

body with matte-painted imagery and restoring backgrounds where needed.

Effects intervention was required for contorted-body shots during the actual exorcism, as well. In one handheld shot, Emily is on her knees — her head bent back at an unnatural angle — as Father Moore (Tom Wilkinson) recites *The Exorcism* ritual. Again, Captive Audience broke up the image in the plate, repositioning her head and twisting it 10 to 15 degrees beyond what the actress could do physically.

Another physical manifestation of the troubled girl’s condition reveals itself in her eyes, which redden and dilate to black to indicate the demon within. Carpenter wore custom contact lenses throughout much of filming, simulating various levels of eye distortion. John Stewart realized closeups of the pupils in the act of dilating, isolating the middle portion of Carpenter’s eye in Shake and building an oversized pupil element to track to it. For a number of shots in which Carpenter had been unable to wear the lenses, due to special-effects debris flying about the set, Captive Audience tracked all-digital eyes — complete with black irises and broken blood vessels on the sclera — to the live-action plates.

The nature of the story and the director’s subtle design aesthetic combined to make *The Exorcism* of Emily Rose an ideal project for Captive Audience’s exploration of digital makeup effects techniques. “Everything lined up just right, and we realized it was a great opportunity to take that additional step towards digital makeups. As a company, that is our future — evolving from a makeup effects company to one that also creates in the digital realm.”

The Exorcism of Emily Rose photographs copyright © 2005 by Sony Pictures.

Return of the King

image

ARTICLE BY JOE FORDHAM

In 1933, RKO Radio Pictures' signature radio mast, radiating animated lightning bolts, heralded what for many became one of the world's great est fantasy adventure films — *King Kong*. Directed by Merian C. Cooper and Ernest B. Schoedsack, the classic tale unleashed a colossal ape from a remote prehistoric island in present-day New York using min iatures, glass matte paintings and stop-motion animation guided by visual effects pioneer Willis O'Brien. Moviegoers flocked to the picture and packed ten shows a day in its opening week at New York City's mammoth Radio City Music Hall.



Generations of movie fans have been charmed by King Kong, the 1933 film adventure about a giant ape, discovered on a prehistoric island, who becomes captivated by blonde starlet Ann Darrow. The picture inspired New Zealand filmmaker Peter Jackson, who, as a youth, attempted to remake it as an amateur Super 8 production, then later, professionally, as an unrealized feature film in 1996. After his blockbuster adaptation of The Lord of the Rings, Jackson mustered key members of that trilogy's creative team to bring the project back to life using state-of-the-art digital, miniature and physical effects, in an emotional retelling of the strange and tragic love story.

The film spawned many imitators and a much-criticized remake by Paramount Pictures in 1976 that eschewed stop-motion in favor of a live-action Kong suit, worn by creature effects artist Rick Baker, and a briefly seen full-scale, standing mechanical puppet created by Carlo Rambaldi and Glen Robinson.

Shortly before the remake appeared, an aspiring New Zealand filmmaker resolved to put his own stamp on RKO's classic. "I was twelve years old and absolutely obsessed with the idea of remaking *King Kong*," recalled director Peter Jackson. "It was going to be on Super 8, in color, with stop-motion animation. I built a little Kong puppet, about 12 inches tall, made out of foam rubber and latex – I still have him, although he's rather decomposed now. My mother gave me her fox fur stole, I trimmed it up, glued on the hairs and made a cardboard model of the top of The Empire State Building. I painted a backdrop of the Manhattan skyline on an old bed sheet, very much like the classic photograph of Kong with the Chrysler Building on the right of frame. I was going to start with the end sequence, but I never got beyond a couple of test shots and some animation with a dinosaur that I made out of plasticine. Then the reality hit of trying to do it all by myself, and I gave up."

Jackson's boyhood dream neared reality 20 years later while he was directing the horror comedy, *The Frighteners*, his first Hollywood-financed feature for Universal Pictures. "The studio had been excited about dailies, and we were starting to talk about what we could work on next," said Jackson. "Universal had the rights to remake Kong, and they called to ask if I was interested. I was aware that Universal had been in a race with Paramount to remake *King Kong* in 1975, but it came as a complete surprise to me when they told me they were thinking of remaking Kong again. I immediately said: 'Are you kidding? This is my favorite movie! Don't phone anybody else!'"

Jackson and his partner Fran Walsh began drafting their first Kong screenplay in April 1996, which was followed by ten months of preproduction. Early designs included an impressive bronze maquette created by Richard Taylor, co-founder of Wellington effects studio Weta Workshop. "I did a little maquette of three T-rexes fighting Kong," Taylor recalled, "and when Pete saw it the next day, he said, 'Wouldn't it be neat to do that at a larger size and send it to Universal to get them excited about the film?' We sculpted it, made it very quickly over a five-week period, and it required a 58-part mold."

Jackson transported the coffee-table-sized sculpture to Los Angeles, assembled it in his hotel room and wowed Universal executives. Work proceeded at Jackson's fledgling visual effects facility, Weta Digital, where digital artist Gray Horsfield led development of a digital model of 1933 Manhattan. Weta Workshop meanwhile enlisted comic book artist Bernie Wrightson to develop designs for Kong's primeval jungle habitat of Skull Island, while Workshop sculptors built main players as foam latex stop-motion animation puppets. "We intended to previz the film with two-frame stop-motion animation," said Richard Taylor, "so we built the puppets to scale, with Kong standing about 14 inches tall." Though the plan was to create animatics with these scaled puppets and environments, the final Kong was envisioned as a computer animated character, augmented with practical insert pieces. "We built a full-size hydraulic hand mechanism, and were planning to use a performer in a suit for the closeups of legs stomping through trees. We also wanted to use animatronic dinosaur attack heads."

In January 1997, a call from Universal halted the production. “It was probably the most disastrous day of my career,” commented Jackson. “It was undoubtedly fed by the fact that *The Frighteners* did not do particularly good boxoffice, but that wasn’t the only reason.” As planned, Kong was to have been released in summer 1998 – slotted between Tristar’s *Godzilla* and Disney’s *Mighty Joe Young*. “There was no way we could get Kong out before *Godzilla*; and with *Mighty Joe* coming along, the studio was afraid people would be tired of big monsters on the loose – so they canned the movie.”

The cancellation of Kong, however, allowed Jackson’s production team to focus on its adaptation of J.R.R. Tolkien’s fantasy trilogy, *The Lord of the Rings* – a mighty project that occupied Weta’s attentions for the next seven years and cultivated a crucible of talent. “When Kong collapsed, it was heartbreaking for us,” observed Taylor. “But, in hindsight, I believe that, although we would have thrown our hearts into Kong, as we did on *Rings*, we weren’t nearly as well prepared as we needed to be – technically or creatively – to tackle such a huge piece of American pop culture. Secondly, it’s arguable that *The Lord of the Rings* never would have been made if *King Kong* had not fallen over. So what was a very sad thing for us back then proved to be a blessing.”

During postproduction of the second *Lord of the Rings* movie, *The Two Towers*, a new regime at Universal re-investigated Peter Jackson’s interest in Kong. The previous disappointment still fresh in his mind, Jackson confirmed his interest – with caution – and proposed starting from scratch, throwing out earlier drafts of the Kong screenplay, which had the heroine as an archeologist’s daughter and her love interest as a burly Indiana-Jones-style adventurer. “We hated the tone of our old script,” said Jackson, “which was very flippant and smart-arsed. We liked some of the set pieces and action sequences, but didn’t like any of the characterizations. We told the studio we wanted to rewrite the script entirely, and we wanted a firm commitment that we’d be making the movie with them. We didn’t want to be canned a second time around.”

Universal committed to a headline-making deal, allowing Jackson and his production team unprecedented creative control in developing their vision of *King Kong*. “We were not slavishly accurate to the original film,” said Jackson, who co-wrote the new screenplay with Fran Walsh and Philippa Boyens. “There was no point in making a color carbon copy of the black-and-white film. Instead, we delved deeper into the characters, and explored the reality of this voyage to Skull Island. It was the way we had approached *The Lord of the Rings* – to make the world feel as real as possible, no matter how fantastic the elements.”

Though by no means a carbon copy, Jackson’s film closely adheres to the plot of the original, beginning in Depression-era New York where filmmaker Carl Denham (Jack Black) mounts a last-minute replacement hunt for an actress to star in his latest wildlife adventure film. Blonde starlet Ann



The design process began with extensive research and physical maquettes. Longtime Jackson collaborators at Weta Workshop, headed by Richard Taylor, closely referenced real-world primates, striving to create a ferocious and recognizably gorilla-like character, with empathic human traits. Weta Workshop sculpting supervisor Bill Hunt refines a series of highly detailed expression studies. The sculptures incorporated extensive scarring and deformities, creating an imperfect physiognomy that reflected the violent history of the character.

Darrow (Naomi Watts) joins the production with screenwriter Jack Driscoll (Adrien Brody) on board a rusty steamship bound for an uncharted isle somewhere off the coast of Sumatra. The ship runs aground on the ruins of an ancient civilization, where natives capture Darrow and present her as a sacrifice to the fiercest of *The Island's* inhabitants, the house-sized gorilla Kong. Denham's and Driscoll's rescue mission culminates in Kong's capture and return to New York, where the creature becomes the star of a live stage production that goes awry, ending in a tragic climax at the summit of The Empire State Building.

Two weeks after completing *The Lord of the Rings*, many of Jackson's crew regrouped to form Big Primate Productions, maintaining the momentum of the well-oiled production pipeline. Returning Rings veterans included production designer Grant Major, director of photography Andrew Lesnie and physical effects supervisor Stephen Ingram. Weta Digital senior visual effects supervisor Joe Letteri and visual effects producer Eileen Moran bolstered their forces with new recruits, including visual effects supervisor Ben Snow, who joined production CG supervisor Matt Aitken to spearhead technical initiatives. Richard Taylor and Tania Rodger continued to oversee creature and environment design and miniature construction at Weta Workshop. Alex Funke returned as director of photography for the miniatures unit, and visual effects cinematographer Brian Van't Hul served as on-set visual effects supervisor.



Weta Workshop sculptor Jamie Beswarick adds facial detail to a full-body maquette of Kong in a quadrupedal pose, based on conceptual art of the giant ape in attack mode. Weta Digital employed high-resolution scans of the maquette to develop a digital Kong.

Production heads held brainstorming sessions on creatures and environments with conceptual designers Jeremy Bennett and Gus Hunter, accompanied by illustrator Alan Lee, who contributed visual concepts while finishing his work on *Rings*. Photoshop designs inspired 3D animatics, which supplanted traditional storyboards and initially focused on the film's climax high above New York, for which previz supervisor Christian Rivers employed a simple 3D Manhattan model that had been built during the 1996 preproduction effort. "I used previz more precisely in Kong than I had before," observed Peter Jackson. "I prevized every significant action scene before we started shooting, which gave us a lot of freedom in experimenting with camera angles. First we choreographed each sequence with a 'God's eye' camera viewpoint, working out fight moves and timings, not thinking about camera angles. Once we got the basic blocking for a two- or three-minute scene, we started covering it with camera angles – low angle, high angle, wide shot, closeup, swirling moves, whatever felt appropriate. Then we threw all of that into the Avid and cut a two-minute sequence with 50 or 60 camera angles, sound effects and temp music. When I went to set, I tried to use angles from that previz. It was a very economical way to shoot coverage."

As previz evolved, Christian Rivers' role expanded to Kong animation director, while animation director Eric Leighton joined the team to oversee animation of more than 30 other varieties of Skull Island fauna. Central to the animation process was the exploration of Kong's character, which balanced authentic gorilla behavior with human-like characteristics. A key collaborator in developing Kong's performance was actor Andy Serkis, who had voiced and performed motion capture for the animated Gollum in *The Lord of the Rings*. Serkis threw himself into research, embarking on a backpacking trek to study mountain gorillas in Rwanda and initiating primate encounters at the Regent's Park Zoo in London.

Serkis' insights added to research underway at Weta that included contributions from a New Zealand primatologist and Jackson's own observations of an extremely rare and famously grouchy 40-year-old albino lowland gorilla named Snowflake, who resided in a Barcelona zoo. "Snowflake was originally the inspiration for Kong," said Jackson. "I was not interested in his albino coloration; but he had such an interesting face, very lined and wrinkled, that he looked like a rather grumpy old man. It was slightly atypical for a gorilla, but full of the character I imagined Kong to have. Unfortunately, Snowflake died while we were in preproduction, but I got to visit him in 1992 while I was at the Sitges Film Festival. I made a special trip to Barcelona, took a lot of photos of him in the zoo, and those photos made their way to Weta."



Weta Workshop also collaborated with Weta Digital to develop coloration, skin detail and fur groom. Special makeup effects supervisor Dominie Till hand-punches human and yak hair into silicone castings of the Kong maquette as reference for digital fur simulation.

Weta Workshop produced a large number of Kong sculptures, including a 1/6-scale full-body maquette by Workshop designer Jamie Beswarick, based on an illustration by Gus Hunter of a giant ape in a ferocious quadrupedal pose. Workshop sculptor Bill Hunt also created studies of Kong's face in a series of 18 clay sculptures, using a stop-motion frame-grabber to align bone structure while defining expressions. A violent history on Skull Island further characterized Kong's appearance. "Peter wanted Kong to be like no other gorilla we've seen before," observed Richard Taylor. "The primary way we expressed that was through past injuries. His forehead has been caved in, rupturing the eye socket, creating atrophy in the muscles and causing the flesh around his eye to droop. He had been heavily clawed through the head, taking the skin back to the bone, and the hair had never regenerated. He had his jaw broken and it re-healed, twisted heavily."

Kong's scale – which ranged in the original film from 18 feet in jungle scenes, to 30 feet in New York, to 50 feet in RKO publicists' imaginations – was determined with an eye toward his interaction with other characters. "We didn't want to cheat his scale the way they did in 1933," said Jackson. "We experimented with different sizes for Kong, thinking about how he would relate to Ann Darrow, to the dinosaurs and to the city. We finally settled on a 25-foot gorilla – based mostly on the size of Kong's hand in relation to Ann – and then scaled our other characters to him."

Unlike earlier productions – and contrary to Jackson's own intention in developing the 1996 version of the film – this *King Kong* would feature no animatronic Kong insert pieces. "We considered building a mechanical articulated Kong hand," recalled Jackson, "but decided we could create a computer generated hand with absolutely authentic-looking fingers, nails and hair, and place that around Naomi Watts much more effectively than trying to match our CG Kong to a physical object."

To place Watts firmly into the CG character's hand, Stephen Ingram's NZFX created a special greenscreen rig. "We made a body cast of Naomi Watts," explained Ingram, "then built a kevlar seat for her with a couple of poseable Kong fingers, covered in greenscreen material, that she could interact with. We mounted that to a hydraulic motion base that had eight axes of movement." Motion control designer Michael Sarkis imported previz data to run the Kong hand motion base through Kuper controls. Operators then manipulated



The quest to find Kong begins with a long sea voyage aboard the S.S. Venture. For wide shots of the vessel, Weta Workshop built a detailed miniature ship, equipped with a steel hull, onboard lighting fixtures and interior furnishings. For the approach to Kong's Skull Island home, modelmakers created volcanic strata from castings of rock formations. The production's miniature photography team – headed by miniatures unit director of photography Alex Funke – then shot motion control ship and rock elements in multiple clean and smoke passes, which Weta Digital layered with digital ocean and atmospheric effects.



Weta Workshop's production chief, the lead effects compositors of Skull Island, and the crew will use of Kong's habitat to avoid by the ship's tenet of omnivory. The whole is a praise of the jungle landscape and the steps with Weta Digital at the planning of the ship's isolation in the jungle as the blinding camera and model moves, based on previz by Weta Digital.

model moves, based on previz by Weta Digital.

providing eyelines from an elevated platform

also enhanced motion capture sessions, where

ure to Kong height, mapping the actor's

stency of performance," noted Christian

choices consistent to Kong's character, but we posed Andy's performance to a completely that to a more extreme gorilla-like roar. At performance. Andy is a very powerful physical could move a lot. No matter how much we of a human-sized performer, so we extended

The Weta Digital creature team explored gorilla motion using a Kong animation rig built from XYZ RGB Imaging Services high-resolution laser scans of Weta Workshop's quadruped maquette. Tests with skeletal, muscle and skin simulations revealed unexpected physical anomalies. "Certain proportional aspects of the model didn't work so well in motion," remarked creature supervisor Dana Peters. "The sculpture had a deep arc in its back, giving Kong a very saddleback look, which was hard to translate into good-looking motion in CG."

Unwrapping Kong from quadrupedal to bipedal pose also proved problematic. "We sculpted Kong in a bipedal pose to make it easier to introduce his muscle rigging. The problem was, this was not a natural pose for an ape and it created extra folds and bulges in muscles and skin in a way that wouldn't happen in nature."

Kong facial setup lead Andrew Camenisch and lead creature technical director Eric Tang fine-tuned the Kong animation rig by returning to nature reference.

"We were getting notes from Peter and Fran that Kong wasn't looking enough like a gorilla," remarked Matt Aitken. "We hit a bit of a wall with the design until Joe Letteri came up with the idea of referring back to the gorilla reference photos that Peter and Fran had loved for Kong's physicality. We picked seven images, lined up our Kong model to the gorilla image and deformed the model to make him match the gorilla profile." Deformations resulted in a broader chest, increased development in trapezius muscles across the back of the ape's neck, and a larger belly. "We had shied away from a 'beer gut' because it was not our idea of what a physically dominant creature should look like; but it is a typical trait of male silverbacks, and it helped to make Kong look more like a real gorilla."

Weta Workshop prosthetics and visual creature effects art director Gino Acevedo provided art direction between the physical and digital realms, and broke in a new tool for the 3D pipeline. "The XYZ RGB scans were very accurate representations of the maquette," observed Aitken, "but some of the details, like pore textures, which were accurate to a real gorilla, looked enormous when we enlarged them to Kong's scale. We'd previously used Pixologic's ZBrush to fine-detail 3D models, but we also implemented a tool called 'Mudbox,' which we had early access to because Weta Digital was working as consultant to the software development. Mudbox extended 3D modeling functions in many different areas and was very responsive. When Gino saw us using Mudbox, he said, 'I've got to have that!'"

"I love Mudbox!" proclaimed Acevedo. "It's very artist-friendly and has a great paint package that allows the user to paint in layers like Photoshop. The guys developing it knew I was a bit of a retard



Shots of the landing party rowing through rough surf were filmed with performers riding an on-stage gimbal rig supplied by physical effects supervisor Stephen Ingrams' NZFX. Rocking motions were derived from tracking markers placed on a boat that stuntmen rowed along the New Zealand coast. On the greenscreen stage, NZFX placed motion-controlled water mortars around the skiff and, timed to the gimbal motion, synchronized wave splashes to strike the performers. Weta Digital created the environment, adding miniature rock pinnacles in a digitally generated ocean with crashing foam and ominous brooding clouds.

when it came to the computer, so they used me as a guinea pig and made it easy to understand. I could sculpt in 3D and do pore textures or lay out scale patterns like I would in clay. It took a lot of those techniques and translated them to the computer.” Using Mudbox, Acevedo handcrafted Kong’s skin to incorporate authentic primate textures, including scans derived from a casting of a deceased ape’s hand – a Bone Clones replica made after a tragic fire at the Philadelphia Zoo. “I resculpted the position of the thumb to make it more opposable, but essentially Kong’s hand was a real gorilla hand.”

Kong’s hands were the starting point for texturing and shading the giant ape. “We were working on Kong’s hand before the face or body proportions were finalized,” recalled Kong CG supervisor Guy Williams. “That worked well for us because it was easier to turn out fast texture iterations of just one thumb. Once we had everything working there, it flowed onto the rest of the creature.” Giant digits required extensive detail. “Apes walk on their front pads,” noted Dana Peters, “so that area was very smooth, but also very callused, with dirt inside the cracks. The back of the paw was suppler, and the front of the paw was like brushed leather. We put a lot of work into the hands because we had shots where we were seeing just an index finger huge in frame. Resolution required a 4K texture across the thumb.”

To create facial skin textures for Kong, Weta Digital put their Gollum shader to action. “A lot of the subsurface scattering in Gollum’s face had a translucent quality we wanted in key areas on Kong,” observed Ben Snow. “We wanted fine detail around the eyes, which had very flexible soft skin – in some ways more complex than Gollum. Unlike Gollum, Kong had no dialogue to convey emotion, so we had to rely on subtleties of detail, particularly around his eyes.”

Kong’s eyes were based on Snowflake’s, which had a dark mottled iris and unusually light sclera, making the gorilla appear uncannily human. The humanizing effect, however, only worked in moderation. “Early Kong eyes looked so human he started to resemble a guy in an ape mask,” said Williams. “We shifted the sclera to a brownish, tan color, darkened the iris and relied on caustic lighting effects to give it shape. That gave us a very dark eye with enough contrast to tell where he was looking and enough richness to make it look real. We simulated caustics using the good old-fashioned pre-render trick of bending the ‘normals’ – the light hit the sclera on one side of the eye, the lens acted like a refractor, reflected caustics to the other side of the eye, which illuminated the iris and created a gorgeous sense of depth.”



Production designer Grant Major built the skiff’s rocky landing site in a backlot water tank at Stone Street Studios in Wellington, where the production was based. NZFX constructed the tank using baskets of rock lined with concrete, piled into shallow levees that contained 300,000 gallons of water. To agitate the water surface, Ingram’s team fitted the tank with a hydraulic cam assisted by two backhoes positioned off camera, with large wooden paddles attached to their shovels to churn the waves. Weta Digital completed the environment with set extensions comprised of miniature elements, atmospheric effects and water simulations.

Kong's character would also be defined by his fur. Special makeup effects supervisor Dominie Till oversaw hair-punching of 1/6-scale silicone castings of Kong's face, arm and body, hand-ventilated with yak and human hair, which, along with real-life gorilla reference, informed the look of Weta Digital's digital fur. "Most zoo gorillas tend to be lowland gorillas," observed Joe Letteri. "Their hair is shorter and grayer, with a reddish crest to the head. Mountain gorillas tend to be a lot bigger, with long, shaggy black fur and sometimes a very distinctive silver back. As we made Kong more dominant and bulky, we swung the fur design more toward a mountain gorilla, giving him a very black face with black fur and a silver back."

To handle the large volumes of fur that would be needed to cover Kong, production software developer Martin Preston revamped Weta Digital's fur engine. "We implemented a lot of under-the-hood optimizations to handle between three to five million hairs in Kong's fur," said Matt Aitken. "Once we set the rendering tools in place, it all came down to styling, which we did in two ways. One was to layer maps across the surface of the creature to control length, depth, thickness, color, curvature and clumping. We also built guide curves that ran through the same space so we could grab and sculpt individual hairs. We did a broad-based groom, then fine-tuned it with guide-curves. That hybrid approach gave us great control."

Kong's size placed unusual requirements on fur thickness. When rendered to look realistic in wide shots, Kong's fur appeared out of scale to human hair. "Compared to Ann's hair," noted Joe Letteri, "Kong's hairs looked like thick jagged rods two meters long. But if we made his fur a little thinner, in long shots he looked like a shiny plush toy, nowhere near coarse enough for real gorilla fur." Weta Digital varied fur thickness shot to shot, suggesting scale by adding 'noise' to fur grooms, layering stray flyaway hairs, rendering sparse areas with straggly lone hairs, and creating matted clumps of fur with accumulations of simulated mud, leaves and blood.



Crew members approach an ancient stone wall that separates a primitive tribal settlement from The Island interior. Weta Workshop developed conceptual designs for The Island culture, extrapolating research in megalithic Micronesian structures, and imagined the wall to mark the perimeter of a long-forgotten city. The production fashioned a village set and lower portion of the wall on location in Mount Crawford, near Wellington. Weta Workshop built the wall as a giant 1/12-scale model, with an even larger 1/6-scale gate section for closeups. Weta Digital then composited elements with digital fire effects.



Islanders capture Ann Darrow (Naomi Watts) and offer her as a sacrifice to Kong, lashing the woman's arms to a cantilevered bamboo crane and lowering her onto a plinth above the jungle. Weta Workshop dressed the wall miniature with 8,000 lengths of miniature bamboo, handcrafted from willow. Alex Funke's team mechanized the miniature boom with motion control and lit the wall with multiple firelight passes. Weta Digital blended lighting passes to create flickering firelight effects, tracked a digital double of Darrow to the boom, then added digital crowd simulations of natives, digital flames and burning oil effects along the wall.

Fur dynamics were driven by Kong's muscle rig. Musculature drove skin motion, and skin motion drove hair dynamics – so as the ape crashed about, impacts sent ripples through his pelt. “We used Syflex dynamics and Weta's proprietary dynamics,” said Ben Snow. “As reference we took the Kong arm maquette out into the Wellington wind and studied how the fur moved. There was an underlying boiling ripple, like waving grasslands, and there was a fine flutter in the shorter hairs. We used guide hair meshes to control larger bodies of fur, and then created flutter using a little noise turbulence.”

In the ten months' research and development that Weta Digital invested in its hero Kong, perhaps the most significant achievement was a highly expressive facial animation system derived not only from Serkis' performance but from a complex analytical shape blender tool. Special project supervisor Mark Sagar first explored how far facial performance could drive gorilla facial musculature with a motion capture test of Serkis, which worked well enough to convince Weta to pursue facial motion capture alongside keyframe animation, translating Serkis' performance to an analytical model of Kong's face.



To depict the ferocious culture of the Skull Island natives, Weta Workshop developed a bizarre array of costume and makeup concepts, including animal bones pierced through faces and nostrils cut open to resemble apes. Final native looks featured extensive body makeup, contact lenses, and prosthetic scarring and piercing effects for roughly 200 extras of diverse cultural descent. Makeup artist Ryk Fortuna affixes silicone appliances to the Skull Island shaman (Vicky Haughton), a keyfigure in the sacrifice of Ann Darrow to Kong.

Sagar consulted with primatologists and with psychologist Paul Ekman – inventor of the human facial action coding system – to discuss comparisons between human and primate facial behavior, then developed facial poses that translated emotions to gorilla muscles. “We created a set of equivalent expressions between Andy and Kong,” said Sagar. “We then took the motion capture and decomposed it into muscle behavior. At that point, we broke the geometric connection and created an ‘expression space’ where we deviated from real gorilla expressions.” A motion editing interface allowed animators to manipulate muscles independent of motion captured action. “If Peter or Fran wanted Kong more fearful, we could pull the risorius muscle, retracting the corners of the mouth without altering the rest of his expression. If Andy roared but they wanted to close Kong’s mouth, we could do that while keeping tension in the lips, to retain his anger.”

The facial capture system generated Kong’s eye motion by extrapolating muscle behavior around Serkis’ eyes. “The motion capture data was of such high quality,” observed Sagar, “we almost always motion-captured eye motion. If Andy squinted, he not only squeezed the outside part of his eye, he tightened his interior eye muscles, and the system could tell where he was looking by deformations in the eyelid. We were even able to record saccadic movements of his eyes darting between fixation points. I always thought that would be impossible, but working on this film gave us the opportunity to have data good enough to capture that.”

Carl Denham’s quest for Kong begins with a sea voyage aboard the S.S. Venture. For establishing shots, the production procured a full-scale coastal trader, once used as an icebreaker, and clad the bow with steel to convert the rifted bow to a vertical plumbed bow more typical of the period. For closer views, shot at Stone Street Studios in Wellington, Grant Major’s team built upper decks as a backlot set – backed by bluescreen – which could be rigged at a canted angle for storm scenes.

Wide shots of the ship at night and in a perilous storm featured a 14-foot, 1/12-scale miniature that Weta Workshop built using AutoCAD files from the full-size ship and a laser-cutting rapid prototyping machine. Modelmakers cut cross-sectional ribs, clad the hull in steel, surfaced decks with diagonal plywood planking, then created weathering effects to simulate years of sea damage. “Wave action on steel tends to scallop out the paneling,” stated Weta Workshop miniature supervisor John Baster, “so after we drew on all the frame lines, we used sanders to slightly dish the hull where we imagined plating had been crushed by the sea. When light raked down the side of the boat, it revealed a pattern that let you know this was a steel boat.” Artists applied acrylic paints over an undercoat of 3M green finishing putty on the hull, then chipped paint away to reveal layers streaked with rust, with a waterline of grime created from spray glue and cotton wool.

Miniatures lighting technician Gerald Morse provided an internal lighting rig for Venture bulkhead lights, which featured tiny custom lenses capable of withstanding long hours of shooting. Interior furnishings included illuminated cabins and a bridge containing a binnacle and telegraph with backlit dials. Jackson had requested that the ship’s lighting fixtures actually illuminate the bulkheads. “The problem,” said Alex Funke, “was that when we



For his eleven-minute short film *Skull Island*, Peter Jackson, writer, director, and producer of the *Rings* franchise, drew on his extensive knowledge of natural history and his love of the 1933 film *King Kong* to create a new world of prehistoric creatures and landscapes. The film is a tribute to the original *King Kong* and the grandeur and diversity of New Zealand's natural landscape – Peter Jackson shot *Skull Island* environments almost entirely on stages in Wellington, using miniatures and digital set extensions to emulate the stylized jungles of the 1933 production, but captured with highly mobile modern camera systems.

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Weta referenced archival sea storm footage and used fluid simulation and keyframe animation to generate wave motion. “We used Maya plug-ins to control physical parameters for wind speed and wave choppiness,” said Horvath. “We used sculpting deformers to grab waves and move them around in real time. We then built a mechanism that allowed us to take one ‘chunk-o-waves’ and combine it with another. In breakwater around rocks, the waves were small, choppy and non-directional; out in the open, waves had more direction and interaction. We blended between regions.” A second layer of physical simulation produced medium-sized and capillary waves using statistical studies of wave motion to analyze surface tension. The ferocity of the storm was then expressed through foam and spray simulations. Horvath and technical director Christopher Young developed ‘Crest Breaker,’ a software tool that analyzed wave height, defined crest points and emitted foam based on features including wind force, wave velocity, ocean swell and fractal analyses of diffusion and decay.

Compositors blended digital water elements in Apple’s Shake with 2D elements of live-action water, the miniature Venture and fog effects, revealing a rocky outcrop that greets the visitors to Skull Island. “As the fog broke up we used 2D fog elements,” said sequence supervisor Mark Lewis. “Elsewhere in the sequence we used 3D fog, with 3D interactive water for the bow wakes and 2D rain and splashes around the rocks.”

The Venture runs aground on a giant carved stone effigy, part of a half-sunken structure that snakes inland, giving Denham his first glimpse of Skull Island – a completely synthetic environment designed to capture the exotic feel of *The Island* as depicted in the 1933 film. “One of the things I always loved about the original *King Kong*,” noted Ben Snow, “was the feel of Skull Island. Peter wanted to capture that same feeling in this film. He wanted it to be like we were looking at the 1933 island, but with modern camera technology – and creating that was a challenge equal to creating Kong.”

“I never felt we could match what I was imagining Skull Island to be by filming on location,” Peter Jackson elaborated. “When we were creating Fangorn Forest for *The Two Towers*, we felt sure we would find a location for that somewhere in New Zealand – all we needed was a big creepy forest! But we couldn’t find it anywhere, and that’s why we ended up creating Fangorn in a studio. We simply couldn’t find a forest that had the mood and atmosphere of the Alan Lee and John Howe production art. When it came to Skull Island, I remembered that. I didn’t want to be caught out twice.”

To test the feasibility of translating conceptual designs into a synthetic Skull Island environment, Jackson commissioned a film test of eight shots featuring a group of explorers walking on



Denham sets up his camera to photograph a brontosaurus herd browsing in the ruins of an ancient city. Weta Workshop designed the prehistoric herbivores, based on a maquette developed for Jackson’s aborted 1996 Kong production, emulating the look of the original film’s stop-motion dinosaurs rather than adhering to more modern paleontological views. Weta Digital generated the creatures, creating variations in size and coloration, and layered the herd into a Weta Workshop miniature of ancient ruins framed by miniature foliage, atmospheric effects and distant matte paintings.

bluescreen sandbags, composited into a miniature tropical rainforest that appeared to breathe with life around them. “Peter had always been dissatisfied with the tendency of miniatures to be static,” commented Alex Funke. “Since this picture was set largely among trees, he wanted wind constantly moving the miniature vegetation. This had never been tried before with motion control, because it is extremely hard to do. First of all, cameras have to shoot at faster than normal speed, otherwise foliage appears to jitter. And when you scale a tree down, stiffness of tree limbs appears to increase in miniature.” The production combated miniature rigidity by cutting sections out of branches, then hot-gluing music-wire springs into place, creating flexible joints of adjustable tension. “The other trick we adopted, which our miniatures unit physical effects supervisor Scott Harens devised, was to load branches with tiny lead fishing weights to increase their weight. By balancing these weights against flexible joints, we created a pendulum that had a very slow period of motion. If that period was correct, filmed at 64 frames a second, it created exactly the right movement for 1/12-scale trees.”

To cultivate a forest of miniature trees, Weta Workshop gathered branches from a local mountain range, the Orongorongos, where indigenous beech trees were exposed to fierce winds from the South Pole that dwarfed vegetation and produced wild varieties of twisted branches. John Baster’s team cut branches into pieces and assembled tree structures with hot glue and urethane foam. Background and midground trees were dressed with plastic leaves, mass-produced by a Chinese subcontractor from Workshop designs. For foreground vegetation, Weta’s greens department cultivated a crop of 20,000 miniature ferns. “We restricted growth by putting ferns in tiny pantyhose bags,” stated Richard Taylor. “These contained growing mix that had no nutrient, so it was like Chinese foot-binding them, and we ended up with little bonsai ferns.” Miniatures unit greensperson Lucy Woolhouse used a greenhouse adjacent to the shooting stage to maintain a rotation of camera-ready greenery.

Weta Workshop created 1/12-scale rocks using castings of strata sampled from Red Rocks Coastal Reserve, which conformed to Jackson’s vision of *The Island*’s shattered, volcanic geological nature. Silicone moldings yielded a dramatic palette of urethane castings classified into 20 rock types. Weta mapped jungle sets by aligning previz to a digital map of the shooting stage. Grips then laid camera tracks to a one-meter grid painted on the studio floor and miniature photography unit model supervisor Paul Van Ommen’s crew positioned rocks on elevated platforms around the track. Modelmakers dressed platform edges with rubber curtains of twisted vines, added trees, ground moss and foliage, sprayed leaves with latex paints and strung weighted rubber vines through



After a harrowing encounter with the brontosaurus herd, the rescue party attempts to cross a jungle swamp using a makeshift raft. The production shot the scene on the backlot water tank, with principals riding a mechanical raft driven by an underwater hydraulic winch and chains. Weta Digital extended the environment using miniature background plates and environmental effects to add a labyrinth of trees overhanging the water. The miniatures unit shot backgrounds of subtly swaying plants using a motion control pan-and-tilt technique. Weta Digital assembled tiles, then layered trees with mist and beams of sunlight, creating parallax effects.

branches. NZFX supplied wind fans and air mortars to create undulating breezes and strategic wind hits to set foliage in motion.

Sets were filled with carefully controlled densities of atmospheric smoke, and then photographed using motion control. High shooting speeds, required for scaling tree motion, put heavy demands on lighting. “The difference between shooting at 24 and 64 frames per second,” explained Alex Funke, “is a stop and a third. A stop and a third at the speeds we were shooting required a huge amount of light; but we still had to be subtle, suggesting patchy light coming through tree canopies. We couldn’t just pour light out of a bucket. That was one of our biggest challenges – getting sufficient light into sets to hold the stop and still shoot at high speeds.”

To maintain a consistent look in the huge number of elements required for Skull Island scenes, veteran matte painting artist Michael Pangrazio joined the production as Weta Digital art director. Pangrazio’s duties included matte painting and, early on, gathering approximately 4,000 digital images of indigenous flora on New Zealand’s South Island to assist in building jungle scenes. His role evolved to working with digital effects supervisor Eric Saindon to maintain the conceptual design process from composite to final image. “Peter constantly referred back to the original *King Kong* for the look of Skull Island,” commented Pangrazio. “He wanted light going back into tunnels, darker foregrounds framing shots, with a lot of depth. We sometimes had so many beautiful little details in a frame that when we put them all together it became overwhelming. In those cases, we had to edit and reorganize the compositions.”



Richard Taylor and Peter Jackson examine a miniature log that will bridge a jungle chasm where the rescue party has a catastrophic encounter with the enraged Kong.

A Venture landing party treks inland and discovers a giant stone wall that appears to rise from the sea, leading to a village of catacombs broken open by ancient seismic activity. “Pete wanted to suggest *The Island* was sinking into the sea,” explained Jeremy Bennett. “If Denham had tried to find it in 1950, it would probably have vanished.” Skull Island architecture was based on megalithic Micronesian structures that dated back to 500 A.D. “We discovered some wonderful structures built using large crystal basalt logs. We extrapolated on that style and imagined that a giant wall once encircled the city, ten miles in diameter with several giant gates, one of which leads through a cemetery. *The Islanders* that live there are not the original inhabitants, and there aren’t too many of them left. All in all, it was a very unstable environment for Denham and company to stumble on.”



The production reworked the classic setting from the original film, introducing a diagonal slope to the log's gradient. Weta Digital enhanced the verdant setting by resizing portions of the miniature, replicating the background to slip below frame, and adding scenic elements to jungle borders. Wide shots featured small animated flying creatures in the ravine and digital doubles of Venture crew members traversing the log.

The production built the village set and a lower portion of the wall on location in Mount Crawford, west of Wellington. Weta Workshop created an array of prosthetic makeups and costumes for its inhabitants. One concept was based on a National Geographic photograph of an extremely dark-skinned warrior who had stained his eyes with red berry juice. Weta Workshop commissioned lens specialists Stacey Sumner and Cristina Patterson Ceret of Professional VisionCare Associates to create 80 pairs of hand-painted scleral contact lenses to simulate the effect. Dominie Till developed body makeup to create oil-black skin pigment, which the prosthetic team applied – with prosthetic keloid scarring and body piercing effects – to 200 extras of diverse cultural descent. Till and Gino Acevedo also created a silicone prosthetic age makeup to cover the hands, face and neck of Maori performer Vicky Haughton, who played the tribe's shaman – a key figure in a scene where *The Islanders* capture Ann Darrow and offer her as a sacrifice to Kong.

The sacrifice takes place in a nightmarish ritual atop the giant stone wall. Islanders bang drums and call for Kong, but keep their distance from the jungle by lashing Darrow's arms to an elongated bamboo structure and lowering her on the boom. “That had Alan Lee written all over it!” remarked Jeremy Bennett. “Alan was still at Weta when we were discussing that scene, and he did some lovely drawings showing how the boom would work. He nailed it pretty early on.”

Jackson filmed Naomi Watts on a greenscreen altar set that included an upper portion of the great wall, a bamboo altar platform lashed to stonework and sharpened bamboo spears pointing out like porcupine quills. Weta Workshop built the wall as a 1/12-scale structure, approximately 15 feet tall and 35 feet long, detailed on both sides to allow up-and-over shots, with an even larger 1/6-scale section for closeups of the gate. John Baster's team assembled the wall in panels, closely referencing conceptual art. "We carved our basalt logs out of wax candles," said Baster. "We then built up real stones around the logs. The logs pinned everything together, their ends showing as they ran back into the wall, held together by its own weight." Modelmakers cast the rock wall surface in panels and clad panels to a wooden understructure. "Once we could see how it was progressing, we cast up larger panels to speed the build. We ended up with a kit of wall textures with big panels around the bottom, little panels in the middle and smaller ones at the top. We hand-carved buttresses and topped it off with a molded capital."

Weta Workshop hand-built gates out of balsa and fabricated native fortifications using approximately 8,000 lengths of timber designed to resemble miniaturized bamboo. "We found a basket maker who grew willow canes the diameter and length we needed," stated Baster. "We built a machine for putting nodes on each cane, wrapping string around them. We then stained them and painted nodes with a little ridge of paint."

Modelmakers built the miniature sacrificial boom at 1/12 and 1/9 scales, which Moritz Wassman mechanized with motion control. Alex Funke's team created interactive firelight effects using multiple lighting passes, which compositors modulated to flicker, replicating practical fire elements across the miniature using sprite technology. Wide angles featured digital doubles of characters on the wall, replicated as Massive agents. Views of the jungle below the wall featured mostly miniature trees with digital interaction as Ann Darrow is snatched from her perch. "We don't reveal Kong at the sacrifice," noted Funke, "he's more of a dark shape. So



Kong grabs the log and shakes it to dislodge his human pursuers. For closeups of men struggling to keep from falling, NZFX built a full-sized log section, with one end mounted to a motion base, and created jostling motions based on previz animation of Kong.



Below, in the ravine, fallen crew members are attacked by giant wetas in a scene inspired by a legendary one deleted from the original 1933 production. Weta Digital model edits Weta after insects indigenous to New Zealand, much enlarged from nature. While foreground wetas were keyframe animated, crowd simulations were employed to produce swarms.

the approach for that set was mostly miniature. Kong rarely interacted directly with miniature elements. Whenever Kong touched the trees, they were digitally animated, to tie his animation to tree motion.”

To create digital foliage, Weta Digital lead technical director Chris George developed “Treebuilder” in Maya. “Treebuilder allowed us to build any type of tree we wanted,” said Eric Saindon. “It built branch systems and leaves and moved them dynamically. We designed trees a lot like the miniatures guys, avoiding specific types, just building trees that looked cool, but unlike anything you might see in your local park. We also wrote a vine-growing tool that grew vines and moss over any 3D surface to help integrate miniature, full-scale and digital elements.”

Set survey supervisor Malcolm Angell’s team used Leica Geosystems Totalstation architectural survey tools to record point clouds of data around rocks and trees on full-scale and miniature jungle sets. Compositors assembled jungle elements using background images projected onto rough geometry in D2 Software’s Nuke, combined with elements layered in Shake using ‘Cyco,’ a custom plug-in written by Weta Digital lead technical director Nick McKenzie. “We sometimes took the locked-off portions of moving treetops and tracked those into motion control moves,” stated 2D sequence supervisor Erik Winquist. “More frequently, they shot jungle environments in tiles, from a locked-off nodal point. We stitched plates together, blended clean-air passes and smoke passes to create atmosphere, projected that onto geometry and used those as backgrounds. We created far backgrounds with layers of matte paintings; foregrounds were mostly miniature. We sandwiched live-action in between and worked in Cyco to project elements onto cards. It was amazing how much of this world we created by projecting onto cards – more than any other film I’ve worked on, by far.”



Fleeing Kong on foot, Darrow runs into a wetasaur – an entirely fictional creature, named after the film’s effects companies. Weta Digital generated the wetasaur digitally, working from scans of a Weta Workshop maquette. Jackson shot Naomi Watts on a bluescreen jungle stage set, closely referencing previsualization of the wetasaur reacting to Darrow’s intrusion and then pursuing her into a millipede-infested hollow log. Weta Digital match moved footage using point cloud data and measurements obtained from surveys of the set, rotoscoped foliage, and layered motion controlled miniature trees and digital extensions around Watts and the creature.

Denham and Driscoll lead a rescue party after Darrow and experience the exotic fauna of *The Island*. “We wanted life everywhere in the jungle,” related Michael Pangrazio. “We had a library of elements we threw into shots to create a sense of biodiversity that appeared to have mutated, supporting the kind of life that appears later.” Weta Workshop designed background creatures as 2D art; Weta Digital built the creatures directly into the computer, creating schematic views, modeling components and texturing in Mudbox. Jon Allitt produced flurries of jungle denizens in Massive, intermingling keyframe creatures.

For hero creatures, Weta Workshop followed its tried and tested route of sculpting and casting large-scale scannable maquettes. Designs deliberately departed from paleontological research. “Our dinosaurs veered more towards the style of Willis O’Brien than *Jurassic Park*,” said Joe Letteri. “They

were a bit more fantastic, and some of the poses were even reminiscent of 1925's *The Lost World*. We took the approach that Skull Island was this island in the Pacific that had been isolated for millennia, and so dinosaurs had survived and evolved."

The first prehistoric giant appears when Denham's men spy a lumbering, crested styracosaur grazing in the trees. Then they discover a herd of towering grazing herbivores, based on a 1996 maquette sculpted by Weta Workshop designer Shaun Bolton to emulate a classic of the genre. "Everybody calls these things 'apatosaurus' these days," Peter Jackson remarked. "It will always be 'brontosaurus' to me! We made a very traditional one, not quite a tail dragger." Weta Digital created variations in 'bronto' size and coloration and used weathering across the creatures' backs to differentiate among the herd. Compositors layered creatures into a 1/24-scale miniature environment built by Weta Workshop to represent a crumbling citadel overgrown with vegetation.

Motion in the trees causes the herbivores to stampede, fleeing a pack of voracious bipedal aggressors, a raptor genus known simply as 'carnosaur.' Weta Workshop designer Jamie Beswarick sculpted the carnosaur maquette in 1996; Gino Acevedo detailed the design in Mudbox, adding facial wrinkles and a detailed mouth interior to the powerful pitbull jaws and sleek physique.

Eric Leighton accompanied the stampede shoot at Windy Point, working with second unit director Randall William Cook, who imparted wisdom gleaned from time in the trenches as animation director on *The Lord of the Rings*. "Quite often, Randy and I would be talking about a scene," related Leighton, "and he'd say to me, 'Well, put the suit on!' I'd dress up in the blue suit, go out and hold the big raptor head and run around, acting it out for elements. A lot of times, if we needed to see somebody butting up against an animal, or an animal slamming another out of the way, we'd just have grips or one of us dressed up and slap them around."

For close views of Venture crew members fleeing the thundering stampede, Jackson filmed his actors running on a ten-foot-wide greenscreen treadmill, which NZFX custom-built for the production. Weta integrated treadmill footage through six miniature environments, following the characters down a steep, narrow gorge, the camera traveling with them as giant brontosaurus feet crash behind them and carnosaurs pick off victims. "We matchmoved the greenscreen elements," explained Eric Saindon, "put them on cards, tracked them to the ground plane and then moved the digital camera through the cards so they all tracked together. We found it helped if we only saw actors' upper bodies, without seeing footfalls on the ground."



Workshop sculptors Greg Tozer, Don Brooker and Shaun Bolton finesse the wetaosaur maquette, based on reference of a Komodo dragon. Artists created scannable resin maquettes of more than 30 hero Skull Island creatures, and provided Weta Digital with designs for skin textures, mouth interiors and eyes. To suggest a diversity of lifeforms filling the jungle, Weta Workshop also provided designs for a host of ancillary background creatures, which Weta Digital built directly in the computer.

The stampede featured 15 brontos enacting five-minutes of pell-mell carnage. “One of the Venture crew in front takes out a raptor with a machine gun,” Eric Leighton related. “As he does so, he shoots the lead bronto in the kneecaps and what follows is the most absurd pileup of bronto flesh you can imagine! We animated all of that keyframe with skinning, muscle and gravity effects piled on top as brontos impacted one another. Everything was so shot-specific, it was more time-efficient for us to do that by hand, down and dirty.”

Adding to the mayhem, NZFX and Brian Van’t Hul shot an array of physical elements of cracking paving stones and exploding dust effects, which Weta Digital compositors mingled with creatures and additional dynamic effects that included falling boulders. “We set up a generic rock and boulder pipeline for showering debris,” related destruction supervisor Gray Horsfield, “and used a slightly new approach for simulations, incorporating a rigid body solver from the gaming industry.” The simulation engine was based on Novodex’s collision-detection and dynamic-motion scripting language utilized with FerReel Animation Labs’ Blastcode dynamic simulation software, which generated simulations for up to 1,200 tumbling objects, rendered at 16 frames per second.



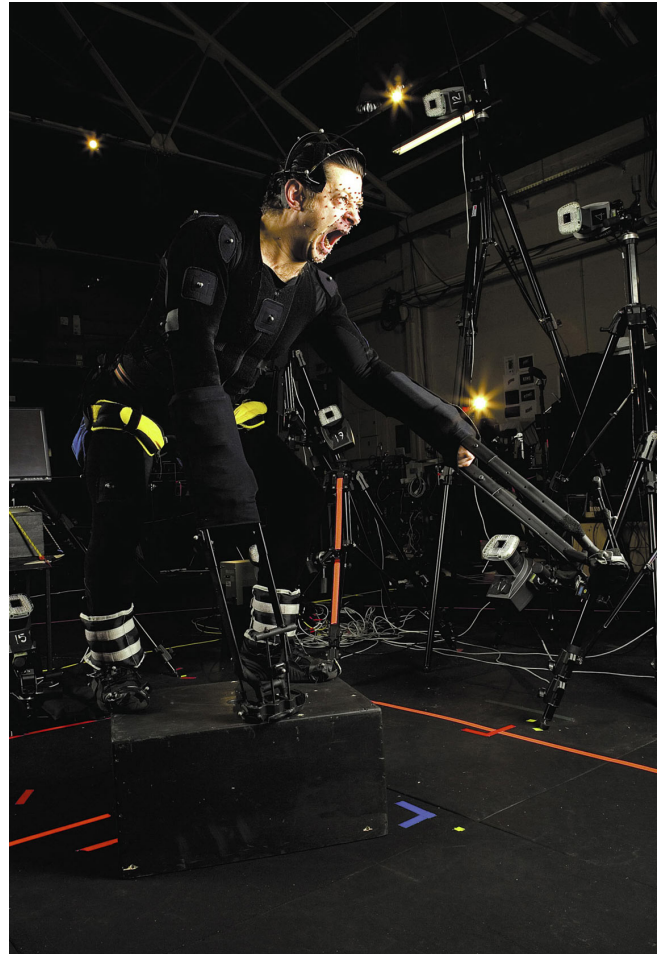
An extended battle plays out as Kong defends Darrow from a family of hungry tyrannosaurs. In the course of the action, the combatants plummet over a cliff, dropping through an entangling network of vines into a clearing where Kong fights a bull T-rex to the death. Weta Workshop created maquettes for a sprightly juvenile T-rex, a battle-scarred matriarch and the formidably muscular bull. Weta Digital layered muscles, fat and skin to accentuate each creature’s dynamic characteristics. Animators strove to balance Kong’s natural ferocity with a host of empathic qualities.

After the stampede, the rescuers attempt to cross a swamp using a makeshift raft. Jackson shot the scene in a 300,000-gallon water tank built by NZFX on the Stone Street backlot, with principals riding a mechanical raft driven by an underwater hydraulic winch. The swamp environment was extended digitally. To add a labyrinth of gigantic trees overhanging the water, Weta Digital tracked production plates; then sequence supervisor Mark Lewis blended miniature jungle layers, creating parallax effects in Cyco.

A giant swamp creature next appears, its dorsal fin breaking water. Weta Workshop designed the creature to resemble an oversized coelacanth. Weta Digital created wake and displacement, using 2D warps on the water surface. For shots of the creature overturning the raft, stunt performers rode a lightweight breakaway raft on a greenscreen motion base. NZFX supplied a bluescreen water element using oil barrels tied together to emulate the creature's full-scale splash. Compositors combined the splash with digital simulations of water running off the creature's back as the predator bursts from the swamp and drags victims to their doom.

Denham's men finally confront Kong at a chasm bridged by a fallen log. Gus Hunter reworked the classic setting from the original film, introducing a diagonal slope to the log's gradient to enhance the peril as Kong attempts to dislodge the Venture crew. NZFX built a full-sized section of the log and bridged the chasm set with the mechanical structure clad in foam, dressed with rubber bark and moss. "The log was about nine meters long and two and a half meters in diameter," related Stephen Ingram. "We put one end on a motion base, programmed movement using previz animation and puppeteered some shots."

Weta Digital placed digital doubles on the log to depict characters falling into the pit below. Brian Van't Hul oversaw motion control photography of a miniature log falling into the chasm, which compositors layered against a Gustave Doré sky. "The crevasse only went down so far," said Mark Lewis. "We took the miniature element, sized it down and replicated it to disappear into frame, hazing off against the sky."



A key collaborator in developing Kong's character was Andy Serkis, who performed motion capture for the giant ape. Serkis researched his role, spending time at a gorilla sanctuary in Rwanda and at a zoo in London, then participated in the shoot, providing interactive eyelines for Naomi Watts and vocalizing Kong's roar through a voice amplification system. Serkis also performed simultaneous body and facial motion capture wearing a variety of prosthetic devices to help transform his body into more ape-like proportions. Scaled up to Kong's 25-foot height, the motion data provided Weta Digital with a ground base from which to craft the giant ape's performance.

The pit below the chasm included a riff on a scene famously deleted from the original RKO production, eliminated for its horrific depiction of Venture crew members being consumed by giant insects and crustaceans. Peter Jackson's pit creatures were equally macabre, including wetas – flesh-eating insects indigenous to New Zealand, much enlarged from nature. “There are quite a few species of weta,” Dana Peters noted. “Peter was more creeped out by the two-inch-long backyard variety, so we based our model on that and went through a few designs and extracted displacement maps to come up with a pincer size that looked threatening but realistic to the proportions of their body.”

Weta animated swarming wetas, scuttling pit crabs and a horde of mutant spiders in Massive, while Eric Leighton's team keyframe-animated foreground creatures, such as an enormous mutant mole cricket – the ‘Obiesuspodex,’ designed by Weta Workshop designer Warren Mahey and named after Kong's creator – and a muddy mass of three-foot-long pit slugs that receive machete blows while engulfing Venture victims.

Concurrent with the pit action, Ann Darrow attempts to escape Kong on foot and runs into a large, quadrupedal lizard with a long shovel snout and powerful tail. “Pete decided that he wanted a new dinosaur,” said Gino Acevedo, “so we gave him a ‘wetosaur’! We used a casting of a Komodo dragon as reference, and sculpted it full-size. Pete said he wanted it to have growths all over its face, so we added diseased boils and made the mouth look filthy, like a real Komodo.” Eric Leighton's team animated wetasaurs chasing Darrow into a hollow log filled with giant millipedes. Brian Van't Hul shot interactive elements of a miniature log crumbling and imploding as the wetasaurs attack. NZFX prodded Naomi Watts with interactive greenscreen sock puppets simulating millipede interaction. Weta Digital then animated giant millipedes, tracked to Watts' body.

Darrow escapes the wetasaurs only to encounter a ferocious family of tyrannosaurs, which Kong then engages in a precarious clifftop fight. For closeups of Darrow in Kong's grasp, NZFX manipulated Naomi Watts in the greenscreen Kong rig. More dynamic interactions relied on a digital Darrow double capable of withstanding prolonged scrutiny. “We wanted to be able to push closer to our digital doubles than we had done before,” said Matt Aitken. “We wanted greater naturalism in the basic shape, cloth and hair detail, and facial performance. We brought in a new scanner developed by the automotive industry in Germany that used structured light rather than a laser to scan the performer's face. It projected a series of grids onto the face, took a series of snapshots and very quickly processed that information. This gave us a much more complete scan, where the performers did not have to hold an expression so long and they could keep their eyes open, which they couldn't do with the laser. It also captured low-resolution color, which helped register detail in the face and gave us a map to work to.”

Weta generated 32 digital human characters for the film, with special attention to Ann Darrow. Mark Sagar developed a digital Darrow facial lighting and animation system using a rig developed by the USC Institute for Creative Technologies. The Lightstage rig surrounded Naomi Watts with an orthographic array of lights and Thompson Viper FilmStream high-definition digital cameras. Watts performed 20 facial expressions, producing 1.2 terabytes of data that Weta used to light and texture the digital double's face and apply shading functions across the model.

Darrow's facial animation used an analytical tool similar to Kong's, defined by Ekman control units. "Ekman broke the face into 96 facial targets," stated Aitken. "We used that classification to build blend shapes in our Ann Darrow model and then created a system of sliders that animators could use to dial in her performance." Naomi Watts' facial expressions became the building blocks for animation blend shapes. "We analyzed facial markers, and used those to dial in Ekman units. It was a very flexible way of working, because if an animator felt Ann's top lip wasn't behaving correctly, for instance, he could modify a couple of shapes without resculpting an entire capture session." To complete the Darrow model, Weta generated hair in Maya, sculpting styles with Weta's in-house hair tool, 'Combover,' and generated cloth simulations in Syflex.



After dispatching the T-rex, Kong carries Ann Darrow to his mountaintop lair, where, from a rocky outcrop overlooking Skull Island, he observes the woman reacting to a spectacular sunset. The moment established a bond between Kong and Darrow, and required close attention to Kong's facial animation. Weta Digital created the facial articulation by translating Andy Serkis' motion capture to an analytical model of Kong's face. The animation system compared equivalent expressions between Serkis and Kong, then decomposed motion capture data into muscle behavior, allowing the animators to manipulate parts of Kong's face while retaining the integrity of the live performance.

Darrow's clifftop ordeal begins with the appearance of a juvenile T-rex, followed by a larger, more muscular bull rex and an even larger, more battle-scarred matriarch. To design the T-rex family, Weta Workshop referenced a full-scale osteological replica of a T-rex skull and added an Evolutionary twist of bony protrusions across the cranium. Sculptors generated full-body sculptures, three and a half feet long from head to tail, with scaly noses and dorsal crests. "The T-rex maquettes were some of the most difficult sculpts we've ever done," commented Richard Taylor. "The crocodilian texture was like a mathematical equation, requiring very careful analysis of the scales. There was no way to cheat it; we couldn't just scratch it in. They took many months to sculpt, with five or six sculptors working on one sculpture at a time."

Weta Digital's creature team interpreted Workshop sculpts by layering muscles, fat and skin to accentuate each creature's dynamic characteristics. "Since the matriarch was a bit more scarred and aged," Dana Peters explained, "she had a lot of wrinkly, saggy skin. We relaxed areas of skin to create jiggle and folds, enhancing the scale so her footfall impacts rippled down her legs. The bull was fitter than the matriarch and a bit scarred, but not nearly as flabby. The juvenile was the young pup, with bigger-proportioned feet. His muscles had a lot of form, but were less developed, with almost no fat whatsoever."

The T-rex fight sends Kong and Darrow over the cliff into a ravine strung with jungle vines where Kong continues to battle the T-rex and Darrow dangles precariously, suspended among the giant creatures. The extreme nature of the action relied extensively on keyframe action, combined with live-action of Naomi Watts in a greenscreen set composited with miniature ravine walls and digital interactive vegetation. The sequence concludes in a clearing below the ravine where Kong confronts the bull T-rex. The conflict included homage to Willis O'Brien's T-rex fight, Kong administering a bone-crunching coup de grace and waggling the T-rex jaw to make sure it is dead.

In Kong's mountaintop retreat at the summit of Skull Island, a bond begins to form between the giant ape and his human captive. Weta Workshop created an expansive miniature of the interior of Kong's lair, and supplied a poignant detail for the full-scale set, revealed as Driscoll creeps by in search of Darrow, passing a skeleton of giant gorilla bones.

"We decided to give Kong a graveyard of his past ancestors," noted Richard Taylor. "Gorillas do mourn their dead, and this was where Kong mourned the loss of the only thing that he had social interaction with – it could be his father or his mother. We wanted to imply he's the last of his kind."

The lair scene included a strangely tender moment as Kong observes Darrow during a sunset over *The Island*, setting up a connection between the giant ape and the woman. "One of the problems with the earlier remake," said Peter Jackson, "was that they had Jessica Lange as Ann – or 'Dwan,' as she was called – talk to Kong. I didn't want to humanize the relationship to that level. So we had no dialogue between Ann and Kong, other than one or two very brief words. As Ann sees the sun set, she utters the word 'beautiful' very quietly, and she makes a gesture to herself. That word – 'beautiful' – takes on more importance later."

The moment is interrupted when Darrow disturbs a flock of gargoyle-like creatures inhabiting the cave, which subsequently attack. Weta Workshop sculpted a maquette representing an emaciated creature just shy of human size with a considerable wingspan. "The cave creatures never see daylight," said Guy Williams, "so we gave them pale translucent red flesh with subsurface scattering – but 10 times more than Gollum to make them absolutely sickly-looking, like a bird that's just been born."

With Kong distracted, Driscoll rescues Darrow, beginning a chase that leads out of the cave, down ancient temple steps to a river – a second-unit New Zealand location, directed by Randy Cook – arriving back at the jungle wall, where Denham and his men are waiting. In close pursuit, Kong attacks the wall, enraged, and smashes through the gate. Alex Funke's team shot village-side



Grotesque flying creatures that inhabit the mountain lair attack Darrow and Kong. Weta Workshop artists Gary Hunt, Don Brooker and Bill Hunt sculpt a scannable maquette of the emaciated cave dweller, which Weta Digital used as the basis for creating the flock of almost human-size creatures with large wingspans. Artists rendered the nocturnal creatures with pale, translucent red flesh, generated using subsurface scattering effects. Wings were conceived as frail membranes spanning from the creature's fingers to its thigh, with loose layers of skin capable of folding and wrinkling.

portions of the wall using the 1/6-scale miniature gate. Weta Digital created digital destruction of wooden structures crashing down using rigid body dynamic simulations.

The ape pursues Denham to an ocean cove and splashes into the water. Weta Digital re-created the ocean surface digitally and generated Kong's interactions using simulations and composite effects. "We disrupted the water surface as Kong wades in," commented Ben Snow. "Our high-end fluid dynamic created those interactions pretty effectively. But that technology can be tricky and expensive, so we used it selectively and shot a lot of water elements out on the backlot in Miramar and used those as 2D elements." Brian Van't Hul and NZFX photographed splash elements using a variety of bluescreen rigs to suggest water interaction, including a full-size concrete Kong foot, lifted above the tank on cranes then dropped into the water.

Gino Acevedo provided tactile reference for Kong's wet fur look by dunking the furred maquette of the creature's arm into a bucket of water. "I expected it to behave like a wet dog's fur sticking to its body," Guy Williams remarked, "but, because of the coarseness of the hair, the Kong arm sagged and clumped, and retained 95-percent of its groom." The digital creature team combed hairs to emulate the wet fur groom. Technical directors then applied maps, shaders and deformers. "Deformers made hairs clump and make ropy strands; shaders created the wet look. We created a separate program to transition between dry fur and wet, so Kong's arm could go into the water dry and come out wet. We did that by toggling between two deformer sets."

Kong falls, overcome by chloroform gas bombs, and the film departs Skull Island in classic Hollywood transition. "It's one of the great movie cuts," asserted Peter Jackson. "Denham stands on the beach and says, 'I can see it now, his name in lights: Kong, *The Eighth Wonder of the World*.' Cut to Broadway and the marquee lit up. As a fan of the original *King Kong*, I always wanted to re-create that moment. It's exactly the same as the original film."

The production created New York City – in all its teeming period detail – entirely in New Zealand, combining digital effects with full-scale sets built on a backlot site in Seaview, adjacent to Wellington. The decision to create the city synthetically was informed by Jackson's positive experience in using the same approach for the finale of *The Lord of the Rings*. "We decided to build New York digitally because the technique had worked so well for us in Pelennor Fields," remarked Joe Letteri. "By building that whole environment, Peter had complete flexibility – and we wanted that same flexibility in New York. We worked very closely with Grant Major while he built a ground-level set of New York and, as that came together, an internal team at Weta wrote all the software that allowed us to build New York above that."

Conceptual development of New York City began with period photographic reference, which was in abundance. "Alfred Stieglitz's shots of Lower Manhattan were my favorites," stated Jeremy Bennett. "They were very revealing, showing pollution from the coal fires of the time, how it broke up the atmosphere and layered the city." Another valuable resource was the UCLA Air Photo Archive, which contained hundreds of aerial survey images of New York, photographed during the 1930s and 1940s.

"New York City is vast," stated Letteri. "We knew it would be impossible to build every building, so we researched what the city was like in 1933, used original blueprints of landmark buildings, like The Empire State Building and the Chrysler Building, then picked city views that were key to the story and built around those landmarks." To map the city footprint, digital effects supervisor Dan

Lemmon employed satellite imagery and a commercially available 3D model of Manhattan, circa 2001. Modelers cross-referenced modern-day structures with Fairchild aerial images and eliminated structures built after 1933. To proceduralize modeling of urban sprawl, CG supervisor Chris White developed a Maya-embedded language script known as 'CityBot' urban development software.

The software broke buildings into components known as 'cells' and sorted structures into architectural styles – Federalist, Beaux-Arts and Italianate to Art Deco. "A couple dozen architecture styles existed in New York from the 1800s to 1933," observed Letteri. "We built 350 cells – windows, doors, roof decorations, water tanks, pigeon coops, park benches, street lights – and CityBot ran rules to build *The Cells* into structures based on those styles. We compared that to period reference photos and refined the rules as CityBot crawled across the city, creating buildings that radiated from 55 hero buildings. It was not an exact copy of the city, but the styles were true to the period layout."

Simultaneous to digital city construction, the backlot set took shape. The set resembled a giant letter 'A,' spanning an area of four city blocks, with the V-shaped intersection containing Times Square and Broadway capable of being redressed to represent Herald Square and the base of The Empire State Building. Most buildings extended one story high. To assist with the addition of digital extensions, survey supervisor Malcolm Angell and his associate Nick Marrison dotted surfaces with reflective markers and plotted AutoCAD geometry. When the set was dressed in its Times Square and Herald Square incarnations, photographers shot panoramic and detailed texture reference.

Weta Digital also hired photographers to shoot city textures and 360-degree panoramas of key Manhattan structures, including The Empire State Building, from dawn to daylight. Sequence lead Sergei Nevshupov and lead lighting technical director Jean Matthews then used backlot textures and location imagery to build a library of textures capable of being applied to CG buildings. "We worked out a technique to bake geometry into simple textures," remarked Chris White. "This created textures with simple displacement and color, and made it easier for CityBot to render buildings." Shaders then projected buildings with more complex textures using luminance values extracted from Fairchild aerial photos and color values calculated from contemporary photographs.



Kong is incapacitated and brought to New York, a location introduced in the opening of the film, where Carl Denham is seen hustling to cast his latest project. The production shot all New York City sequences in New Zealand, combining digital effects with full-scale sets built on a backlot site near Wellington, allowing Jackson creative control to stage complex action scenes in the teeming city. Digital extensions consisted of 55 hero buildings and a vast sprawl of more generic structures created using

CityBot, developed at Weta Digital to proceduralize large-scale urban modeling. The backlot set resembled a giant letter 'A', and spanned an area of four city blocks, with the V-shaped intersection replicating Times Square and Broadway, capable of being redressed to represent Herald Square and the base of The Empire State Building. The production dressed the sets with relatively small greenscreen backings, relying heavily on the skills of Weta Digital rotoscope and 2D paint departments to facilitate digital extensions. Final composites included digital crowd simulations of pedestrians and period street traffic generated in Massive, the motion-capture-based artificial intelligence crowd simulation engine.

To generate the city's period atmospheric haze, Weta used research in partial differential 'Poisson equations' – named after mathematician Siméon Poisson. "Joe Letteri pointed us to a Siggraph paper about Poisson equations," recalled 2D sequence supervisor Charlie Tait. "The paper was about analyzing gradients in foreground and background images, but there was a little footnote that said these equations could be used to de-haze photographs, using depth maps of a scene, sampling haze coloration and comparing it to black." Weta tested the theory on a photo of a 1930s Manhattan skyscraper canyon, aligned to a depth map of the image derived from the CG city model. "We analyzed the depth and colors and utilized Poisson equations to remove the haze. We used an inverse of that process to create haze through our city."

Weta created grit and texture using a procedural technique to simulate effects of weathering on building façades. "We knew we wanted to dirty up the city without hand-painting every building," Chris White explained. "So we developed an image-based system that allowed us to rain on buildings to create streaks of dirt. We set up a 3D camera and manipulated code in Maya to make it rain thousands of particles onto buildings. Being image-based, it used all the high-rez geometry and displacements in the models and baked that in with a ton of resolution." The weathering system created after-effects of rain and snowfalls across tens of thousands of buildings, including snow collected in awnings and piled on sidewalks.

NZFX furnished practical dirty city snow on the Seaview set using 120 tons of magnesium sulfate to 'ice up' roads and footpaths. Technicians built snowdrifts using 6,000 bags of loosely packed tree bark, covered with white fabric and bolted to the ground, sprayed with 130,000 square feet of foam and dacron polyester fiber. To create effects of steam venting from Con Edison's famously leaky subterranean heating system, NZFX supplied two steam boilers and plumbed the set with 6,500 feet

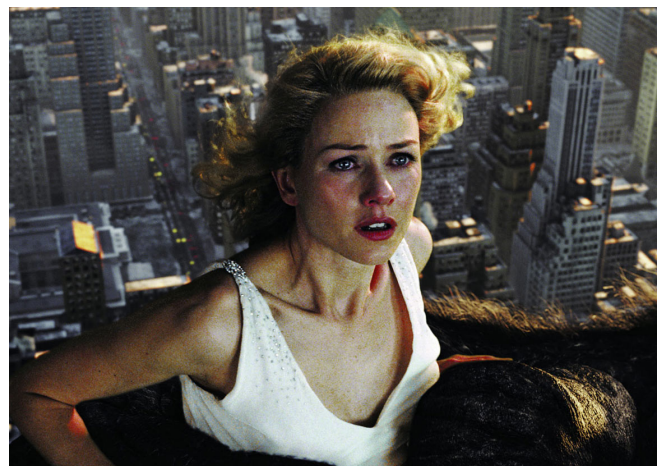


Kong escapes from Denham's Broadway stage production, runs riot in New York searching for Ann Darrow, and then, reunited with her, seeks refuge atop the city's tallest skyscraper, The Empire State Building. Three partial sets were built for mid-ascent closeups – where Kong rests on a ledge, the observation deck and the top most dome – used for greenscreen photography of Naomi Watts. For wide shots of the landmark, Weta Digital built a 3D model from original blueprints and developed an additional model aligned to practical set pieces.

of steel pipe, dug up to three feet deep and insulated in concrete to prevent the high water table from cooling steam back to water. Pipes fed a grid of 90 individually controlled steam sources in the street, allowing NZFX to dial up plumes at the production's request.

The city is first seen in a montage opening the film, showing views of the practical set, crowds and traffic, enhanced with the digital city populated with Massive crowd and vehicles. Weta favored the Ford Model A as the 1930s vehicle of choice, with modifications to represent trucks and period Chevrolet taxicabs as programmable Massive variations. "We set up our vehicle agent by scaling the wheelbase to different geometries," said Jon Allitt, "and then used the same animation brain, with suspension rattle dynamically built in. We added potholes and tram tracks in roads if we needed a bit more variety, but we didn't want viewers to focus on traffic. Most of the detail was in the models, and we had real cars in shot so we knew exactly how to match the shaders and the rendering."

Jackson filmed Seaview sets with relatively small greenscreen backings, relying heavily on the skills of rotoscope and 2D paint departments to facilitate digital extensions. An early scene featuring Ann Darrow and a vaudeville impresario included a long, tracking shot that followed the couple from a theater office, across a street, under an elevated train to a restaurant. The production plate had bluescreens reflected in puddles, bluescreen above the restaurant and a series of poles representing the underside of the train. Weta composited buildings into reflections using 2D stills tracked to the plate, painted out a camera crane and assistant director to the left of frame, cast the shadow from the el-train with a 3D train and track above, and then extended the shot to include a crane move rising to a high view of the city as the train crossed frame. "We created rough geometry of the scene," said Ben Snow. "On top of that, the compositor extended the camera move, rising up off the set in 2D, and added the el-train. Background buildings were pretty accurate to the geography of New York. Matt Aitken used our city model to pinpoint the area we were in. We rendered that and tweaked to taste. Then we added Massive cars and people, and passengers in the train."



Kong cradles Ann Darrow in his massive paw as a brilliant sunrise illuminates the city.

With Denham's return to New York, Times Square is ablaze with neon as pedestrians throng outside a Broadway theater marquee promising the Eighth Wonder of the World. Kong's stage appearance turns chaotic when press photographers' flash bulbs startle the ape, causing him to break his shackles and run amuck. Weta created destruction interactions as digital dynamic simulations tracked to theater interiors shot at the Civic Theatre in Auckland. "Kong rips up the seats," related Gray Horsfield, "and tears the balcony level down, with many theater patrons – rendered as Massive agents – getting hurled around the theater. To do that, we incorporated Massive's 'rag doll' system into our destruction pipeline." Horsfield also created a dynamic simulation of the Eighth Wonder theater façade, which explodes into Times Square as Kong bursts from within.

Kong's rampage continues as the ape searches for Ann Darrow, plucking blondes at random from groups of terrified passersby. The path of destruction included two miniature environments – a 1/12-scale 'Hooverville' shantytown of Depression-era shacks and a 1/10-scale frozen lake in Central Park. Weta Workshop outfitted the park with miniature conifers, beech trees, a bridge, park benches and practical street lamps.

Ape-versus-vehicle interactions included automobile collisions, a trolley car encounter and Kong ripping through the tracks of an elevated train. Stephen Ingram's team provided crushed vehicle aftermaths. Weta Digital generated crushing vehicle effects using rigid-body constraint systems tailored to period automobile dynamics. "The Ford Model A was a lot more rigid than a contemporary car," observed Horsfield. "They didn't have crumple zones like modern vehicles. I went through hours of crash tests and destruction derby footage, then extrapolated from that. We fed that into a destructible vehicle model that went into the lighting pipeline." The destruction pipeline permitted more than 70 vehicle smashes to be animated with high degrees of proceduralization, saving custom builds for specific carnage.



Unlike the 1933 original and the 1976 remake– and contrary to Jackson's plans for his unrealized 1996 version of the film – the production featured no animatronic Kong insert pieces. NZFX instead built a mechanical greenscreen hand rig with poseable fingers that wrapped around the actress, who rode a kevlar seat on a hydraulic motion base. Operators controlled hand motion utilizing either previz data fed through motion control, or real-time via waldo control.

Kong seizes Darrow and carries her aloft, climbing The Empire State Building while the military mobilizes on the streets below. The Empire State Building was the most detailed city structure created for the production. Practical sets included the base on the Seaview backlot and three partial sets for mid-ascent closeups. “The first level was where Kong stops to rest on a ledge,” said Brian Van’t Hul. “Grant Major’s team decorated it with metal Art Deco wings, then removed those and redressed it for where they climb a little higher. We then had a portion of the observation deck, just underneath the dome, where Ann runs around as Kong is defending her. Finally, they make their way to the top, which was another set.”

For wide shots of the landmark, Weta Digital built a 3D model from original blueprints, which resulted in disparities between bluescreen sets and the CG model. “The practical sets looked great in closeup,” remarked sequence lead Craig Wentworth, “but they didn’t have exactly the same material properties as the real Empire State Building. We had shots that cut directly from the practical set to the digital extension, and the CG set had to match exactly; so we built a set extension model as well as our hero model and used our hero model in wide shots that conformed more closely to the real building’s proportions.”

Aerial views of Kong’s ascent featured the film’s most extensive New York City vistas, lit by slowly dawning sunlight. Matte painter Rachael Haupt created a digital cyclorama for the far distance, painting the sky as an unwrapped dome mapped with photographic cloud textures. Weta commissioned a New Zealand photographer to shoot skies tailored to the mood of the scene. “The time period was very important,” said Dan Lemmon. “Sky colors changed so dramatically over a short period, we had to use imagery shot at exactly the right time. We shot more skies and ended up combining five different images for our master view, which evolved through the sequence, starting before sun-up through sunrise.”

Weta modeled mid-distance geometry of New Jersey and Brooklyn and digitally generated the East River with sky reflections, water traffic and boat wakes. CityBot generated Manhattan wide views in four chunks, facilitating the rendering of huge quantities of geometry and textures. Weta layered the elements – blending sky with river and city, patchy levels of smog and chimney smoke – establishing a methodology for rendering the gargantuan expanse. “We rendered a turntable of all the 3D elements surrounded by the cyclorama,” explained Charlie Tait. “That allowed us to view the city from every possible angle, so we could check lighting from all directions. It allowed me to composite the city seamlessly into the cyc from every possible angle, and it gave us an almost automatic way of lighting all the shots. By rendering all our 3D and all our passes through a couple



Six U.S. Navy biplanes swoop toward The Empire State Building as Kong rests with Darrow on a ledge below the observation tower. Weta Digital generated the vast expanse of New York City using a digital cyclorama of the sky painted onto an unwrapped dome using custom photographic cloud textures tailored to the mood of the scene. Mid-distance detail featured geometry representing New Jersey and Brooklyn and a digitally generated East River, with sky reflections, water traffic and boat wakes. CityBot generated Manhattan Island in four sections, which Weta blended with the sky and river, patchy levels of smog and plumes of chimney smoke.

of Shake scripts, we ended up with a close approximation for how shots would look in the final comp.”

The turntable streamlined lighting of aerial city views for a sequence lasting more than 300 shots, encompassing more than 80 layers in wide shots. “We sampled usual chrome ball values and colors from production plates,” said Craig Wentworth. “We came up with a dome of 32 lights to create keylight and ambient light values across the city, but we found it tricky to balance all the fills with the brightness of the sun, so we refined it to a nine-light rig.”

Bluescreen photography of Empire State Building sets – lit with warm keylights and cool fill to create a dawn effect – posed a challenge in lighting Kong. “We had to make sure Kong continued to look like a black-furred ape,” remarked Lemmon. “However, any neutral color – like black – placed in a warm light, immediately looked brown. It was very difficult to fit Kong into the environment without him looking like a brown monkey.” Weta solved the issue by handling the creature’s lighting shot by shot. “We couldn’t use a global lighting setup for Kong,” said Joe Letteri. “We lit him as if we were lighting live-action. If he looked too dark, we popped in a few extra fill lights. We had to light him in a way that fit both the on-set live-action lighting and the wider city views.”

As dawn breaks over Manhattan, Kong rests to gaze at Ann Darrow in his paw, triggering a memory of his earlier introspective scene on Skull Island. “Fran came up with the idea while we were scripting,” recalled Peter Jackson. “As the sun appears over the skyline at the top of The Empire State Building, we reprised the ‘beautiful’ moment from Skull Island. We had Kong repeat Ann’s gesture that she recognizes as ‘beautiful.’ It’s the first time in the movie there is a sense that Kong has learned from his time with Ann. It’s a very gentle exchange between the two of them.”

Kong and Darrow are interrupted by the arrival of six U.S. Navy biplanes that proceed to dive and open fire. For biplane closeups, Jackson – an aviation buff and collector – commissioned a local aviation manufacturer to supply a Curtiss O2C-2 ‘Helldiver,’ as used in the original film, built from scratch since no known models of the plane were in existence. Stephen Ingram’s team mounted the aircraft, minus motor and propeller, to a motion base and rigged machine guns to fire blanks. Filmed against bluescreen, the motion base created aircraft rocking motion, assisted by wind fans and a moving keylight simulating the sun.

Weta Digital generated a digital model of the aircraft based on the replica, adapting textures from the practical aircraft, and animated muzzle flashes, shell-casing ejections and tracer fire. Taking a cue from Schoedsack and Cooper, who portrayed a biplane pilot and gunner in the original film’s air attack, the production filmed cameos with Peter Jackson riding shotgun in one aircraft with a



Valiantly attempting to defend Darrow, Kong grapples with the attacking planes and eventually collapses on the summit of The Empire State Building, mortally wounded by machine gun fire. Jackson downplayed the violence of the scene and focused on Kong’s tragic fate, allowing Darrow a last tender moment with her leading man. Andy Serkis performed the scene with Watts on a bluescreen set, providing the actress with a physical and emotional presence despite the disparity between his physical size and Kong’s.

special celebrity guest star. “I was a gunner and Rick Baker was the pilot,” Jackson revealed. “Rick came out to New Zealand to do the cameo for us. He thought that it would be very appropriate to be the pilot who finally shoots down Kong, given his experiences acting in a sweltering ape suit for great chunks of time in 1975.”

Kong makes a heroic attempt to defend Darrow, swip-ing at attacking biplanes. Weta peppered masonry by texture-bombing model surfaces and, as Kong scores a hit, wrecked digital biplanes using destruction simulations to rip apart wings and fuselages. The creature team pummeled Kong with high winds, ruffling fur with wind dynamics, and in early renders riddled his flesh with 32 bullet hits, streaking fur with blood. Final bullet hits were reduced in size and number. “Despite my earlier career,” commented Jackson, “I didn’t want the ending to turn into a gore fest. It was not appropriate for this movie. I tried to balance what was happening to Kong with keeping people emotionally connected to the scene.”

Mortally wounded, Kong collapses on the dome of The Empire State Building and, in a final heartbreaking gesture, extends a single digit to Ann Darrow, who weeps for his demise. Andy Serkis performed the scene with Naomi Watts on the partial bluescreen set, providing the actress with a physical and emotional presence despite the disparity in his physical size. Watts performed the final embrace with a bluescreen finger form. Weta Digital animated a vertiginous down-view that cranes above The Empire State Building, gently rising and rotating, as Kong falls in slow motion. “Pete wanted Kong’s death to be poetic,” remarked Christian Rivers. “One of our early previz artists, Paul Griffin, designed the shot with a nice drifty camera move, so as Kong fell away from the building, his body loose, you really felt the depth of him falling down the tower.”

Kong’s inert body is revealed on the street below, surrounded by onlookers – filmed on the Seaview backlot set. “The previz department created six poses of dead Kong,” said Brian Van’t Hul. “Pete picked one and, based on that, we laid out a meter grid on set and marked where he’d be lying to keep people out of that area.” Weta Digital then tracked and rotoscoped the shot and composited the lifeless ape among the crowd for the film’s final pronouncement that beauty felled the beast.

Mounted on a scale that, in many respects, outstripped *The Lord of the Rings* – with more visual effects than any single Tolkien film, and more creatures and miniatures than the entire trilogy combined – *King Kong* pushed all levels of production to new heights. “This film was just as big and complex as *Rings*,” said Joe Letteri. “The style of filmmaking that we’ve developed with Peter, and the way we’re working at Weta, is that we don’t want to be bound by anything. If someone has a good idea, especially Peter, we’ll try to get that on screen. Of course, it still takes a finite amount of time to build and develop our resources. On *Rings*, by the time we got to the third film, we had our pick of a treasure trove of creatures and props to use wherever we needed. We were working to that same level with Kong – without five years to build it! But we’ve now become used to packing that work into a smaller time frame, and we worked really hard to make sure it looked good.”

Despite the workload, Weta also contributed to a DVD restoration of the 1933 film and found time to stage an April Fool’s Day stunt promising two completely fictitious *Son of Kong* sequels. The enthusiasm was testament to an enduring fascination with O’Brien’s ape. “Many of our younger people had never seen the original film,” admitted Richard Taylor, “so we had a screening. They all appeared to suffer the stagy acting style for the first five minutes, but then they were all drawn into

the movie to the point that a number of our crew were moved to tears. It proved this film still had great resonance and was a sublimely beautiful piece of storytelling. We wanted to bring back to life this piece of cinema history, and to have audiences relate to Kong in a way they'd not engaged with a non-human creature in a film before."

Ultimately, empathy with Kong was key to the success or failure of the film. "I always felt that we love Kong because we understand his tragedy," concluded Peter Jackson. "What's truly at the heart of *King Kong* is that we feel this creature has lived a very violent, brutal life. He's the last surviving ape on Skull Island, he's been very lonely, and Ann Darrow opens a small door in his heart. It's the first time he has ever empathized with another living creature. Kong allows himself to respond, and his protective instincts fail him. The basic irony and the terrible tragedy is that Kong follows his heart and that leads to his downfall. That, I think, is what gives the story its power."

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Deep Magic

image

ARTICLE BY JODY DUNCAN

Had it occurred on any date other than November 22, 1963, the passing of Clive Staples Lewis would have aroused much media attention and commentary. He had been one of the great thinkers of his time: an English Literature fellow at Magdalen College, Oxford, the chair of Medieval and Renaissance Literature at Cambridge, a lecturer, newspaper columnist and radio commentator, the author of many scholarly papers and articles, as well as more than 20 books on a wide range of subjects, from literature to theology, and genres, from science fiction to autobiography. With all of these accomplishments to his name, Lewis would be forever best known as the author of seven volumes of children's literature titled *The Chronicles of Narnia*, a series of deeply metaphorical fantasy stories that had entranced – and would continue to entrance – millions of readers, young and old.

Overshadowed as it was by the assassination of an American president, Lewis' death was not a public spectacle, but rather a quiet slipping away. Among those who privately mourned his passing was J.R.R. Tolkien, an Oxford colleague and friend. These two learned men's thoughtful conversations, their shared passion for fairy stories and medieval tales, and their mutual encouragement had inspired and informed Tolkien's *Lord of the Rings* trilogy and Lewis' Narnia series – although *The Lion, the Witch and the Wardrobe*, the first 'Narnia' book to be published, strained the friendship, as the methodical and detail-oriented Tolkien was put off by the narrative's hodgepodge of mythical and folkloric creatures from any number of different cultures and eras. Unconcerned with such academic distinctions, Lewis had happily populated his Narnia with hags, ogres, dwarfs, fauns, centaurs, minotaurs, witches, giants, talking wolves, beavers and lions, and – much to Tolkien's annoyance – had even included a brief appearance by an entirely anachronistic Father Christmas.

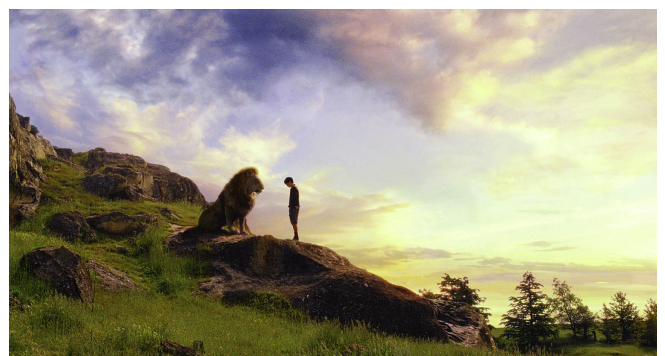
Set in England during the Second World War, *The Lion, the Witch and the Wardrobe* introduces four children who have been sent to the country estate of an elderly professor to keep them safe from nightly air raids on London. Exploring the professor's house, the youngest, Lucy, climbs inside a beautiful carved-wood wardrobe, and suddenly finds herself transported to Narnia, a mystical country currently under the wintry spell of the evil White Witch. Awakened by the Deep Magic at the heart of the land, Lucy and her siblings, Peter, Susan and Edmund, later return to join forces with the lion Aslan, defeat the witch's army, and bring a long-awaited springtime to Narnia.

At the time film rights to *The Chronicles of Narnia* became available in 2002, the first two installments in Peter Jackson's *Lord of the Rings* trilogy were well on their way to becoming critical and boxoffice phenomena, proving that a complex piece of English literature with a basis in fantasy could be successfully translated to film and draw big audiences. With that in mind, Walden Media aggressively pursued and ultimately procured the rights to all seven of the Narnia books, then united with Walt Disney Pictures, director Andrew Adamson and producer Mark Johnson to realize *The Lion, the Witch and the Wardrobe* as a full-length feature film.

Unlike *Lord of the Rings*, however, which, for all its complexity, featured humanoid characters almost exclusively, *The Lion, the Witch and the Wardrobe* would be populated with a panoply of mythical species and sentient, talking animals, the very characteristic of the book that had so offended Tolkien. “I used the friction between Lewis and Tolkien over this issue as part of my argument to the studio for having those many different types of creatures in the movie,” remarked Andrew Adamson, a one-time visual effects supervisor who had proved his directing chops with his skillful helming of DreamWorks’ animated features, *Shrek* and *Shrek 2*. “I told them, ‘If C.S. Lewis was willing to end a friendship over this, it must have been pretty important!’ That variety of creatures was crucial to the spirit of the book, and to the spirit of the movie, as well. There is a final battle in the story, and what made that battle exciting to me was that it wasn’t just aliens against man or orcs against man – it was a whole menagerie of creatures on one side fighting a whole menagerie of creatures on the other side, each of those creatures using its unique talents on the battlefield. Although, intellectually, the studio was supportive of that idea, when it came down to the actual cost of creating all those creatures, there was a little chipping away of my original list – but we still wound up with many varieties.”

Adamson’s take on the material, which was to remain as faithful to the book as possible, had won him favor with the Lewis estate; but everyone recognized, from the beginning, that the story would have to be embellished for a feature-length film. “When I reread *The Lion, the Witch and the Wardrobe* as an adult, in preparation for this movie, I was shocked to find what wasn’t there,” recalled Adamson. “I thought, ‘Where’s all the stuff I remembered from reading it as a child?’ And I realized that my childhood imagination had embellished a lot, and that C.S. Lewis had relied on the reader’s embellishment. He said things in the book like, ‘I can’t tell you how bad this was, otherwise your parents wouldn’t let you read this book.’ And, as a kid, you think, ‘Oh, man, that must be bad!’ Your imagination fills it out.”

In constructing a screenplay for the film, Adamson and co-screenwriters Ann Peacock, Christopher Markus and Stephen McFeely did likewise, fleshing out narrative details, characters and relationships. Storyboarding served as an extension of that writing process, as did previsualization. Starting early in the film’s development, Rpin Suwannath led a small previz team in Los Angeles, working directly with Adamson, then continued the process well into production. Simultaneously, a team of artists and designers that included Crash McCreery and John Howe conceptualized Narnia environments, filling a room at the film’s Frozen Lake production office in Los Angeles with hundreds of renderings.



C.S. Lewis’ classic children’s tale, *The Lion, the Witch and the Wardrobe*, makes its live-action feature debut in a film

directed by Andrew Adamson. Set in England during the Second World War, the book – the first of seven volumes published as *The Chronicles of Narnia* – recounts the tale of four children who discover a portal to the mystical land of Narnia with the beauty and magic of Narnia. Sony Pictures Imageworks, one of three primary visual effects contributors to the show, created aerial views digitally, the most troubled of the siblings, Edmund (Skandar Keavins), building computer-generated plane models and texturing them with photos of an authentic World War II-era bomber. Imageworks also composited greenscreen elements of pilot performers on gimbals into CG cockpits.

Half a world away, the talented team at Weta Workshop, under the direction of Richard Taylor, designed the 50-some creatures that would populate the fantasy world. Due to Weta Workshop's previous and substantial obligations to Peter Jackson's *King Kong*, however, Taylor could commit only to designing the creatures, leaving their realization to the show's practical and visual effects practitioners. The Weta Workshop team would also design and produce all of the armor and weaponry for *The Lion, the Witch and the Wardrobe*, a major undertaking in itself.

Practical creature effects were awarded to KNB EFX Group, under the supervision of Howard Berger, a lifelong 'Narnia' enthusiast, and his business partner of 19 years, Gregory Nicotero. To gauge, early on, which visual effects companies might best serve the production, Adamson, Johnson and visual effects producer Randy Starr commissioned five contenders to produce an animation test of the talking beaver who befriends the children and leads them to Aslan, the leonine lord and ruler of Narnia. Initially, the filmmakers' intention was to award the entire show to one effects house, which would then work closely with production visual effects supervisor Dean Wright. However, as the production evolved, and the shot count grew from an original 800 shots to more than 1,400, the workload became more than a single effects house could bear. Ultimately, the majority of the work was divided between Rhythm & Hues and Sony Pictures Imageworks – the former awarded the 'spring' sequences, which included all shots of Aslan and much of the final battle between Aslan's forces and the witch's army, and the latter given 'winter' sequences, which involved Mr. and Mrs. Beaver, a talking fox, CG wolves and CG leg-replacements for Mr. Tumnus, the faun Lucy befriends during her first sojourn in Narnia. In postproduction, Industrial Light & Magic joined the team, executing CG leg and body replacements for half-human/half-creature generic characters, such as fauns and centaurs, and adding CG crowds to sparsely populated live-action scenes.



Lucy (Georgie Henley), the first of the children to discover Narnia, meets a nervous but kindly faun, Mr. Tumnus (James McAvoy), shortly after her arrival in the land, which is under the wintry grip of the evil White Witch. Mythical creatures such as fauns and centaurs were created via a collaboration of the visual and practical effects teams. For Mr. Tumnus, Howard Berger and his KNB EFX Group designed and applied a makeup that included a fiberglass skull cap with horns and twitching mechanical ears, and hair meticulously hand-laid on McAvoy's face and torso.

Principal photography on *The Lion, the Witch and the Wardrobe* began in June 2004, and wrapped seven months later, in January 2005 – an exceptionally long shoot, as it involved children and animals, elaborate visual effects sequences, and many weeks of exterior work in locations plagued with volatile weather. “Children, animals, visual effects and bad weather conditions are the four things everybody always warns you to stay away from,” noted Adamson, “and we had all four of them!”

Adamson shot most of the film’s spring sequences on New Zealand’s South Island, where erratic weather conditions dogged the production throughout principal photography. “I grew up in New Zealand,” Adamson commented, “and the weather has always been changeable, but nothing like this. Summer traditionally starts around the 1st of December there, but we had snow on the 18th of December. There were days when it would be a fine sunny morning, but by the time we set up, it would be hailing. Or we’d start a scene, and it would be overcast; and then the kids would go off for a costume change, and by the time they got back, it would no longer be overcast. So we’d have a guy whose job it was to watch the clouds and cue us when the sun went behind them – ‘Okay, get ready Énow, go!’”

To provide cover, production shot sets and greenscreen setups on makeshift soundstages throughout New Zealand. Stage sets included winter environments dressed with fake snow, which would be extended digitally through matte painting, 3D set construction and tiled-together background plates shot in the Czech Republic and Poland. “Very early on, we found these great winter environments in Central Europe,” Adamson recalled, “and, for a while, we considered shooting all of the winter exteriors there. But we didn’t like the idea of shooting with kids in minus-20-degree weather. We did shoot a couple of weeks with the kids in the Czech Republic in February 2005, after we’d finished principal photography in New Zealand; but, for the most part, we shot the winter scenes on stages, then shot plates for our backgrounds.”



Berger attends to McAvoy’s makeup as Andrew Adamson reviews previz for the scene on a portable monitor unit. McAvoy wore green-colored tights on set, which Imageworks replaced with computer-animated faun legs in postproduction.

For production to catch the appropriate seasons, both in New Zealand and Central Europe, the schedule had mandated that the winter stage sets be shot prior to the location exteriors – a reversal of the normal procedure, which is to shoot exteriors first and then match those in the studio. “We had to do it the other way around,” stated Adamson, “and it was a really tricky situation. We’d dressed a foot of snow at Tumnus’ house on stage, for example, but when we got to the location that Tumnus’ house was based on, a recent heat wave had turned the snow to slush. We actually started preparing to move to Poland the next morning, but we were saved that night when we got 27 inches of snow.” Matching lighting was another concern, which director of photography Don McAlpine addressed by keeping the lighting on the stage sets as neutral as possible. “We’d figured out the direction of the lighting and those kinds of things a year beforehand, during our scouts, and we tried to re-create the location lighting on set. But Don was smart about never pushing the lighting too much. He kept it fairly neutral, in case the location lighting had changed a lot, knowing that we could always manipulate it in the digital intermediate.”

In addition to coping with changing weather and lighting conditions, Adamson often found himself shooting live-action scenes that represented only a fraction of what would be in final shots after digital environments and computer animated characters had been added. The preponderance of CG characters in the movie meant that the child actors – Georgie Henley as Lucy, Skandar Keynes as Edmund, Anna Popplewell as Susan, and William Moseley as Peter – had to perform long, complex scenes with characters that were not present on the set, a less-than-ideal acting environment that had stymied many an adult performer. The situation was especially acute in regards to Aslan and Mr. and Mrs. Beaver, with whom the children had to form real and meaningful relationships. “When it was just a matter of giving the children a sense of spacing and eyelines,” Adamson explained, “we would place a lighting stand-in ‘stuffy’ into the scene. But if more subtle dynamics were called for, I would perform the animated character on set, either slightly off-camera, or even on-camera, and then visual effects would remove me from frame. Overall, the kids were better at playing to a tennis ball than the adults were – probably because they exist in that imaginary state anyway – but whenever possible, I would do the scenes with them, playing Aslan or Mr. Beaver, just because it was the easiest, quickest way to direct their performances. Just by altering the way I said my lines, the actors would change the way they played the scene.”



Mr. Tumnus leads Lucy to the entrance of his cave home. For most of the Tumnus shots, Imageworks retargeted motion capture of McAvoy’s on-set performance onto the CG faunlegs to ensure that the character’s upper and lower regions would appear to be moving as one.

Although Adamson, Wright and the producers had recognized from the outset that most of the fictional creatures would have to be created through computer animation, they were open to whatever on-set creature solutions KNB's Howard Berger could offer. "I didn't want to limit what Howard was willing to do," Adamson commented, "which, due to his enthusiasm, was far beyond what we were paying him to do! I gave him the opportunity to go beyond what I really thought we would end up using; and, as it turned out, we got a lot of shots out of those practical creature effects – shots that were originally going to be CG."

Prior to arriving in New Zealand, where he and a crew of 42 artists remained for the entire seven months of principal photography, Berger hired 120 people at KNB to assist in the fabrication of 170 practical creatures representing more than 20 individual species, including dwarfs, cyclops, ogres, hags, fauns, giants, unicorns, goblins, minotaurs, centaurs, satyrs, minoboars and a mole-like creature called a boggle. KNB became a virtual 'Narnia factory,' cranking out hundreds of prosthetics, suits and animatronic heads in the course of a few months.

Of all the characters in the movie, none would be more critical – for both the practical and visual effects crews – than Aslan. Under the supervision of special makeup effects artist Jeff Himmel, KNB produced three Aslan puppets, starting with cyberscan data of a three-foot Weta maquette. From that cyberscan data, KNB produced a full-size, rigid-foam mockup of Aslan, which was broken apart into separate sections – head, front legs, rear legs and body – and molded. The reassembled form was covered in synthetic fur procured from National Fiber Technology.

In addition to a non-articulated lighting stand-in, KNB built a fully-animatronic Aslan, used for some shots in the Stone Table scene, in which the great lion is beaten, shorn of his beautiful mane, and killed. The radio-controlled puppet had full head and eye movement, twitching ears, and lip, tongue and jaw movement. The mechanical understructure was covered in a foam latex skin, and painted by Lenny MacDonald, who was part of the production creature effects team. Himmel then spent a week flocking the puppet and punching hair – including hair from the ten Aslan crew members – into the mane.



When all four children return to Narnia, they are befriended by Mr. and Mrs. Beaver. Imageworks computer animated the beaver characters, building the models according to a Weta Workshop design. For shots of the characters talking, Imageworks employed the proprietary facial muscle system the company had developed for the human characters in The Polar Express. Among the animation challenges was striking a balance between Mr. and Mrs. Beaver's anthropomorphic characteristics and their more naturalistic animal behaviors.

Four puppeteers brought the puppet to life on set, three on radio controls and one beneath the Stone Table, operating a pump to simulate breathing. “It was so beautiful and felt so real,” Howard Berger said, “it really helped everyone on set. For the scene that follows the Stone Table sequence, when Lucy and Susan go to Aslan after his death, Andrew wanted to have the puppet there and running, to make Aslan as believable to the girls as possible. We stopped operating it during the scene, of course, because Aslan is supposed to be dead at that point; but we had him moving when they first came on the set, to sell the idea that this wasn’t just a prop. When the girls sat down next to the puppet, Georgie, who played Lucy, hugged the head and petted him – and Andrew very quietly said, ‘And rolling.’ The scene played out beautifully from there.”

For shots of Lucy and Susan riding astride the lion after his rebirth, KNB constructed a head-to-toe riding puppet, cut off at mid-belly and mounted to a track on a greenscreen stage. “It was like an old Western horse rig in that it could do a kind of rocking motion so that it looked natural when the girls were riding it,” Berger explained, “but it had all of the bells and whistles – full rotation in the head, eye blinks, tongue and lip movement.” The speed of the rocking motion was increased or decreased via a rheostat, while puppeteers operated the head using radio controls.

Ultimately, only the girls were extracted from the greenscreen footage, the Aslan riding puppet replaced entirely with Rhythm & Hues’ CG character. “We had thought that we might be able to use pieces of the puppet for closeups on the girls,” noted Dean Wright, “where only a little bit of the lion’s back would be in frame. But we found we couldn’t cut from the CG Aslan to this rig. His fur blew so gracefully in the wind in the CG version; and the fur created for this rig, while it looked great, just didn’t move in the same way. So the puppet was used only for the motion, and to help the kids get the feel of riding on this thing. We extracted the girls from it, with their riding motion, and put the CG Aslan beneath them.”



Imageworks artists computer animated talking wolves that comprise the White Witch’s police force, using sophisticated fur tools that enabled them to match their CG wolves to the wolf/dog hybrids filmed on location. Final renders were so photorealistic, live and CG wolves were often featured side by side in a single frame.



Like the beavers, Imageworks’ fox was rigged to talk via the company’s facial muscle system, altered to accommodate the fox’s longer, more pointed muzzle. Secondary animation and a fur dynamics simulation maintained a sense of life in the character, even when he was at a stand still.

Mister Tumnus was another major assignment for KNB. Though, like all fauns in the film, Tumnus would be completed in postproduction, with Sony Pictures Imageworks' digital effects artists tracking CG goat-like legs to the performer's body, KNB was responsible for designing, building and applying a custom makeup for the character's upper half. "Mr. Tumnus was the makeup I was most terrified about," Berger admitted. "It was our first makeup that was going to be shot, and yet we didn't have an actor for Tumnus for the longest time, because Andrew was having a difficult time casting the role. When he finally found someone he liked – a young Scottish actor named James McAvoy – we still weren't going to be able to do tests on him, because he was in production on a show in London and was unavailable! I kept arguing with Andrew, because I just didn't see how this could work. And Andrew kept saying, 'I know – but this guy has to be Tumnus.'"



As Mr. and Mrs. Beaver lead the children to a meeting with Aslan, the group attempts to cross a frozen river to escape the White Witch's menacing wolves. The sequence combined footage filmed on a full-size frozen river set – complete with gimbaled ice floes – Imageworks matte-painted set extensions, and two miniatures built and photographed by New Deal Studios.

As a compromise, McAvoy flew out to Los Angeles one Friday night, after his London production had wrapped for the day. "In order to get back to the set of his show on time," Berger said, "James had only six hours from the moment his plane landed in Los Angeles until he had to get back on a plane to London. So we did all we could do in six hours. We took him over to CyberFX to have him cyberscanned and brought him to KNB for lifecasting and makeup tests. Then James flew back to London, went straight to the set there – and nobody was the wiser that he'd been out of the country. After he left, I wrote an email to Andrew and the producers, telling them they'd been right to stick with James, despite his limited availability – because, even in the short time I'd spent with him, I could see that he was going to be magnificent. I said in my email, 'James McAvoy is Mr. Tumnus – the best casting ever!'"

The Tumnus makeup required three makeup artists and three-and-a-half hours' application time. The process began by fitting McAvoy with a fiberglass skullcap with twitching mechanical ears, created by KNB mechanical supervisor David Wogh, which could be either radio- or cable-controlled. Makeup artist Tami Lane had punched wispy hair into the cap's silicone ears to create a subtle peach-fuzz effect. A custom wig was positioned on top of the fiberglass headpiece, followed by horns that screwed into the skullcap, and a gelatin nose tip. After applying paint to create an even skin tone, KNB artists hand-laid hair onto McAvoy's face and body, blending fur-covered 'bike' shorts with hair on the actor's torso. "We hand-laid hair to blend from the pants to his body at the waist," said Berger, "continuing up to his chest, up his back and along his arms. We easily spent \$5,000 on hair every time we applied Mr. Tumnus."

Under the direction of fabrication supervisor Beth Hathaway, KNB also built four mechanical heads, two dozen stunt masks and 25 full-body suits for the bull-like minotaurs. The suits were foam-sculpted, with rigid-cast kneecaps, elbows and rib cages, liquid-filled sacs to simulate bulging biceps, and hair that was hand-tied by Mark Boley's hair department. KNB designer Scott Patton sculpted the hero heads, which had full eye rotation and blinking, moving ears, jaw open-and-close and side-to-side movement, and lip movement. Although hero full-body shots of the minotaurs would feature digital lower halves, background characters sometimes wore leg extensions built by Harrison Lorenzana to create the illusion of an extra-jointed leg.

In contrast, full-body shots of the half-man/half-horse centaurs would always require visual effects intervention – although KNB was able to provide a practical solution for shots in which only the top portions of the horse were in frame. Centaurs were familiar, and dreaded, terrain for Howard Berger, who had been tasked with building the creatures on more than one prior occasion. “Centaurs are the biggest pains in the rear end of everything we do in this line of work,” Berger commented, “always have been, always will be. And this centaur had to be much more sophisticated and refined than anything we'd done before.”

Recognizing the inherent challenge of producing a believable, dynamic centaur, Adamson had initiated its design at Weta Workshop early in preproduction. “I'd never seen centaurs done right before,” Adamson stated, “and I wanted to do them right for this movie. But just designing them was tricky. Finding the balance and blend between the human body and the horse body, so that it would look like one creature, was very difficult. I didn't want the human part of it to be enormous, but it still had to be in proportion to a horse. It was a problem that Weta struggled with; but what they finally designed was really beautiful and elegant. ”

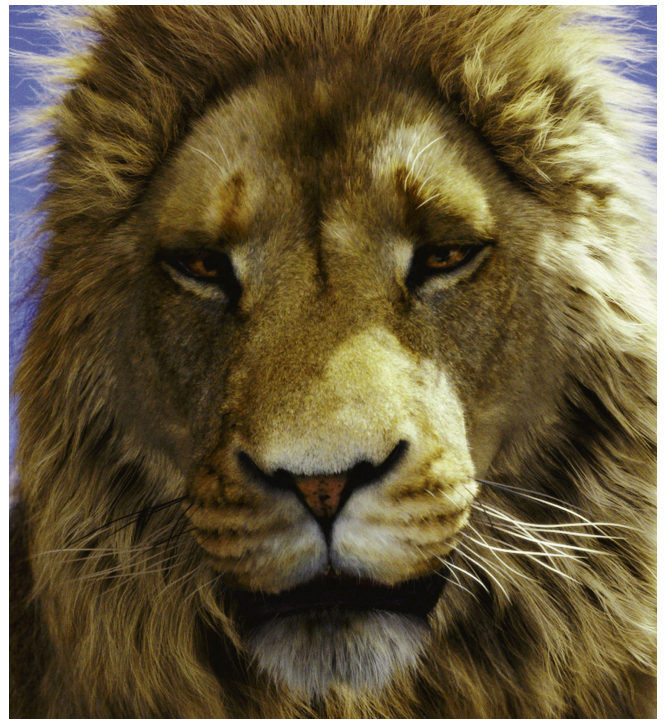
Working from Weta's design, KNB created 40 horse suits representing the length – but only the topside region – of the animal's back, which could be used in some mid-range to close shots of the centaurs. “The whole back end was attached to a wheel-rig so that the performer could walk around,” explained Berger, “and a certain percentage of them had mechanical swishing tails that were cable-operated.” The centaur performer would step into the neck hole of the horse suit, then be strapped into it with a series of belts and cinches. The actors also wore makeup to create the noble upper-body look of the Weta centaur design. “We applied full foam-rubber appliances to all the performers, as well as long wigs and manes. In the battle scenes, they were in full battle gear, as well, which Weta had made. It was very arduous for the actors who played centaurs, because on top



New Deal built a 1/12-scale landscape featuring the frozen waterfall, river banks and forest, referencing drawings provided by the production art department to match the live-action waterfall set. Cast foam rocks were applied to a styrofoam understructure to create the contours of the steep shoreline, while the waterfall was dressed with rows of resin icicles cast in various shapes and sizes. New Deal also constructed a larger-scale waterfall, rigged with pneumatic rams, for shots of the frozen structure collapsing.

of the two-hour makeup and dragging around this horse body, they had to wear all this heavy armor.”

Centaur performers stood on fourteen-inch-tall greenscreen-covered platforms to elevate them to the appropriate height in relation to the human characters. The platforms also served to create a suitable amount of space around centaur actors when they performed without the horse rigs, leaving room for tracked-in CG horse bodies. “We always had to remember to leave room for these large horse back-ends,” recalled Dean Wright. “We were constantly reminding the performers that they couldn’t move too much or get too close to anything. And we made sure the other actors were aware that they couldn’t walk right be-behind a centaur because there was going to be this whole horse body there. Usually, the platforms cleared enough space and kept people from walking through where the CG horse would be.”



Rhythm & Hues was assigned some 200 computer animated shots of Aslan, a central character in the book and the film. To create Aslan, Rhythm & Hues started with scan data from a Weta Workshop sculpture, then shot moving and still high-definition photography of a real lion from every conceivable angle and distance to employ as reference. In addition to studying natural lion behavior, Rhythm & Hues reviewed Gregory Peck’s celebrated performance in To Kill a Mockingbird as reference for Aslan’s noble mien.



Due to the relatively late casting of Liam Neeson as the voice of Aslan, Rhythm & Hues animators had to commence animating the character before there was a vocal performance to guide them. The first Aslan scene to be animated was also one of the most difficult – the ‘Stone Table’ sequence in which the great lion is shorn, beaten and finally killed by the White Witch (Tilda Swinton) and her minions.



Lenny MacDonald paints a shorn animatronic Aslan built by KNB for the Stone Table sequence. Though ultimately replaced with Rhythm & Hues’ CG version in most shots, the puppet allowed for realistic on-set physical interaction between Aslan and the actors.

Whether centaur, minotaur or faun, all of the actors playing half-human/half-creature characters wore green tights, creating a matte area for background restoration and the addition of CG limbs. Behaviors and movement styles of the creatures were determined prior to the shoot, so that the performers portraying upper human halves could be instructed as to how to move on set. “The upper halves played by performers had to move around in the right way,” said Rhythm & Hues visual effects supervisor Bill Westenhofer, “so that when we replaced their legs with creature legs, the two halves would work together and look as if they were all part of the same character. We were especially concerned about the fauns and the centaurs. How were we going to get the upper half to move in a way that would integrate with the movement of the lower half? How would we make that convincing?”

To explore appropriate upper-body movements, R&H first animated an all-CG centaur and faun, without taking into consideration the real physics of the human body. “We just approached it as, ‘Ideally, how would we want a centaur or a faun to move?’” Westenhofer said. “Then we reverse-engineered that 3D animation to see what we needed the live performers to do to get that look. We explored everything from having performers walk on pogo sticks to putting them in high heels and knee braces.”

Ultimately, upper-body faun, minotaur and centaur movements were worked out in a series of sessions on a makeshift motion capture stage in New Zealand with James McAvoy – who, as Tumnus, would set the standard for all the faun movement – and Shane Rangi, who would portray both Otmin, the minotaur general of the White Witch’s army, and a sentry centaur. “We had Giant Studios build a motion capture setup near one of our shooting stages,” recalled Dean Wright. “When James first arrived in New Zealand, he worked with Giant Studios’ Matt Madden and me for several days, exploring and refining movement techniques. In between lighting setups on the nearby stage, Andrew also would come over and give James direction. Because of this mocap technology, as James tried different actions, we could all watch in real time how each pose or foot position would translate into a faun with CG legs. Through this process, we determined that no additional shoe or leg appliance would be needed. It was best if the actors stood and walked with their legs ever so slightly bent, keeping on the balls of their feet as much as possible.”

This pre-shoot mocap period enabled Adamson and McAvoy to set the final look for Tumnus prior to filming. “Once we saw how successful it was with James,” Wright said, “we did the same thing with Shane, who explored minotaur stance and movement, as well as fighting techniques, for all of the battle scenes. These basic locomotion techniques were later taught to all of the reverse-leg performers, to help ensure the continuity of creature movement within each species.”



Production visual effects supervisor Dean Wright often wielded a non-articulated Aslan head ‘stuffie’ – also fashioned by KNB – in shots to set eyelines and maintain spatial relationships between the lion and the actors. Wright’s green garb enabled Rhythm & Hues artists to more easily remove him from frame when the Aslan stand-in was replaced with the computer animated character.

During filming, McAvoy and Rangi were again motion captured on the set by Giant Studios. The motion capture data would not only aid registration, enabling digital artists to lock CG appendages to the live-action performer, it would also allow for the performer's movement to be retargeted onto those CG legs, so that the resulting animation would look as if it was moving in correlation to the actor's upper body. Just as the actor's real torso and legs moved in tandem on the set, his real torso and CG legs would move as one on film.

To augment the on-set motion capture of hero characters, R&H animation director Richie Baneham and motion capture coordinator Michelle Ladd oversaw a six-month-long motion capture endeavor in Los Angeles – which ran simultaneously to principal photography – to generate animation for the generic fauns, minotaurs, centaurs and other creatures that would be created in Massive, the crowd simulation system developed by Stephen Regelous for *The Lord of the Rings*.

Before initiating the motion capture sessions, Westenhofer, Ladd and Baneham met with stunt coordinator Alan Poppleton in New Zealand to determine what behaviors and actions would be required of the Los Angeles performers, to ensure that they would be motion capturing the same movements as those being captured on the set. Andrew Adamson had very specific ideas for the movement of each creature, including the fighting styles they would display in the epic final battle sequence. “Andrew wanted the fauns to fight with very elegant swooping motions, for example,” said Westenhofer, “whereas the boggles would just bore into people. We went character by character, making those decisions. Michelle had motion capture performers act out some of these movements, which she videotaped so that Andrew could approve them. Then, using that tape, Alan could go to his stunt performers on set and show them how their characters had to act and move – while Michelle went back to the motion capture performers in Los Angeles and showed them the same thing. That way, everybody was working off the same guideline.”

One of the challenges of the generic motion capture assignment was that, due to the way in which Massive would utilize the data, performers had to execute very small bits of independent action. “It wasn't like normal motion capture,” commented Wright, “where you have a guy do a bunch of different moves all at once, and then apply it to a character. Capturing the Massive motion was much more abstract. We had to capture a bunch of really small pieces of motion, which would then be blended and put together in the Massive brain. It was a painstaking process.”

An even more painstaking task was motion capturing horses for the back-end animation of centaurs. Executed both at an equestrian center in Los Angeles and on location, the sessions involved motion capturing the animals as they performed various behaviors and actions, such as running, rearing and dressage. A key consideration when doing the motion capture for the human half of the



Rhythm & Hues' remaining shots figured prominently in an epic battle sequence, in which the White Witch's army clashes with Aslan's forces for good. Thousands-strong armies on both sides were comprised of 40 distinct species. Some, like the minotaurs and centaurs, were performers in KNB suits and mechanical heads, to which Rhythm & Hues tracked CG animal legs. Exotic animals such as tigers and polar bears were entirely computer animated.

centaur was ensuring that it would look as if it was driving the movement of its lower equine half. “Unlike a horse and rider,” stated Westenhofer, “the human half of a centaur can’t look as if it is reacting to the motion of the horse. It has to look as if it is in the lead, driving the motion of the horse. As we knew we couldn’t control the real horse too much, we motion captured it first; and then we motion captured the actor as he tried to re-create the cadences and movements of the horse – which didn’t work very well. We ended up capturing the performer just sitting on a chair; then, procedurally, we found a cadence for the legs that we drove in through Massive to the upper half. By shifting around the cadence to lead the horse, it wound up looking as if the performer was driving the movement, rather than just responding, after the fact, to the way the horse was moving.”

Though horses were available for motion capturing the centaur back-ends, and motion capture was employed as much as possible to drive all the Massive characters, keyframe animation was still required for some of the exotic animals, such as big cats and bears, that would be featured in the film. “The more animalistic movements had to be generated through keyframe animation,” said Richie Baneham, “just as if we were doing it for a hero scene, because nobody wanted to try to put motion tracking markers on a cheetah. We did all of that supplementary animation through keyframe, and then fed it into Massive. In some ways, it was a very removed process, just like the motion capture sessions, because the specific pieces of animation by themselves were very abstract. We were generating animation that didn’t make sense until it was processed and blended with other actions. That was one of the real improvements in Massive on this show, its ability to beautifully blend and combine two separate pieces of motion, whether keyframed or motion captured.” A crew of a dozen animators dedicated solely to the task spent four months generating animation to feed into Massive.

Rhythm & Hues had been on the movie nearly two years by the time postproduction had its official start, dedicating much of that period to the development of Aslan, which would represent approximately half of the company’s 380-shot workload. Before committing to a fully computer animated Aslan, the filmmakers had considered using a real lion for some shots, executing CG muzzle replacements for the talking scenes. But the idea was quickly abandoned. “One of the difficulties,” stated Adamson, “was that we couldn’t have a real lion working with the kids. It was about this same time that Roy of Siegfried & Roy was attacked by the tiger; and so any ideas I had about putting the kids with a real lion quickly vanished. In most of the Aslan shots, he was going to be talking, which meant that the majority of the shots would have had to be CG anyway. We had enough difficulties to deal



KNB crew members Beth Hathaway and Clare Mulroy ready performer Shane Rangi for his role as minotaur general Otmin. In total, KNB built 25 full-body minotaur suits, as well as four mechanical heads and two dozen stunt masks. Hand-tied hair covered the foam-sculpted suits, which had rigid-cast knees, elbows and rib cages. Used extensively on location, hero minotaur heads were mechanized to execute full movement of eyes, ears, jaw and lips.

with as it was, without adding the problems of shooting a real lion.”

Weta Workshop designed Aslan, producing a three-foot-long sculpture that was shipped to Los Angeles for digitization. “We started with that data,” said Westenhofer, “but we still needed a lot of good reference – not only for Aslan, but for all the CG characters we were doing for the final battle. To get that, we took still cameras and a high-def camera to a trainer’s ranch in Frazier Park, and about ten of us got into a cage with a lion, a bear, a cheetah, a leopard, and a lot of other animals. The trainers were in there with us, and the animals were on leashes, so we were able to get in pretty close and shoot a ton of incredible closeup reference, both still and moving. As we were building our creatures, we could put our digital model on one side of the screen and the real creature on the other, and compare them feature by feature to see if they matched.”

Rhythm & Hues built the Aslan model using a combination of Maya and an in-house modeling package. Once the model was completed, Richie Baneham and his 42-member animation team – including Aslan leads Matt Logue, Erik DeBoer and Joe Ksander – began developing animation, with Ksander concentrating on accurate lion walk cycles. “The great thing about developing this performance,” Westenhofer noted, “was that Andrew wanted Aslan to be authentic in terms of anatomy and behavior. We’ve worked on a lot of animal films where we created what was supposed to be a real cat, for example – and then it gets up and dances, which screws up the whole illusion. Aslan was going to be a perfect specimen of a lion, but he was still going to be a real lion. One of the concerns early on was how to make Aslan act and emote, but still maintain that sense of a real lion.”

The effects team attacked the problem from two directions, first going through many reference photographs, looking for still frames of lions in which they looked sad, angry, contented, et cetera. “We constantly referred to those still frames as we were creating the performance,” Westenhofer stated. “We also looked at certain actors that we thought would convey the appropriate sense of nobility. Richie Baneham struck on the idea of using Gregory Peck for Aslan, particularly his performance as Atticus Finch in *To Kill a Mockingbird*. That was perfect.”

Having a specific actor on which to base the Aslan performance was critical because, to complete the task in time, R&H had to begin animating the character well before the voice had been cast. First up on the animation schedule was the sacrificial scene with Aslan at the Stone Table. “That was turned over to us first because it was shot early,” said Westenhofer, “and because there was no Aslan dialogue in the scene. Since the voice hadn’t been cast yet, it made sense to start with a scene with no dialogue. It was a huge challenge, though, because we had to find Aslan’s performance before we had a voice to guide us.”

“The scene at the Stone Table, where he is dying, was one of the most subtle scenes to animate, precisely because he doesn’t say anything,” Adamson asserted. “It was especially difficult to find his character in a scene in which he was being very stoic and quiet. It also had one of the most emotional moments in the movie, when he makes eye contact with Lucy as his last breath leaves him. We all knew that scene was going to be very challenging.”



In addition to the minotaurs, KNB produced makeups and suits for 19 other fantastical and mythological species, including cyclops, centaurs, goblins, dwarfs and ram-horned satyrs. Howard Berger and his crew of 42 artists remained with the production in New Zealand for the entire seven months of principal photography, working in tandem with Weta Workshop, which, in addition to designing creatures, designed and fabricated all of the armor and weaponry for the show.

While investing great effort into nailing Aslan’s performance at the Stone Table, the animators knew that once a voice had been cast and that actor had put his stamp on the character, they might very well have to re-animate the scene. As it turned out, the original animation played perfectly, even after the casting of Liam Neeson as the voice of Aslan. “It was actually a huge bonus for us when Liam Neeson was cast,” Baneham remarked, “because Liam is very similar to Gregory Peck in many ways. He has a big presence, but his performances are always subtle and subdued. As it turned out, we didn’t have to change the animation at the Stone Table at all.”

For Aslan’s facial animation, R&H created a library of poses and expressions, matching both the lion still photographs and Peck’s facial nuances in *To Kill a Mockingbird*. Animation rigging also had to accommodate the pure mechanics of lion behavior, such as roaring. “If you watch footage of a lion roaring,” Westenhofer observed, “you see that his whole face contorts. We had to build all of that into the system, as well. Our facial animation rig had just about every animation deform trick known to man, everything from muscle base deformers to traditional shapes to blend shapes.”

Modelers started with sculpted shapes, then pulled points to hit key extremes. “We had a muscle rig that could look at that and determine, ‘For this point to be here, these specific muscles have to fire,’” Westenhofer noted. “The muscle system was anatomically correct, and the end result was a blend shape that had an understanding of the muscles and how they were working.” An even finer level of animation detail was achieved with a subset of the original muscle shapes. “The muscles themselves did further interpolation as we went from one blend shape to another. And then, on top of that, we had some harmonics and dynamics applied to certain soft-body areas. At the jaw, for example, we had the rigidity of the actual jaw line, but there was also a looseness at the soft corners of the mouth. Those dynamics kept it alive and moving.”

Facial animation had to allow for Aslan’s speaking lines of dialogue, as well. To study the range of muzzle motion in a real lion, animators went back to the images captured at Frazier Park, where they had shot high-def video of a lion chewing a variety of objects. “We looked at the articulation in the muzzle,” stated Baneham, “looking for natural shapes that we could then relate to phonemes. In

the talking scenes, we never stretched the mouth movement beyond what a real lion would be physically capable of doing. And we found that as long as it wasn't over-articulated, it looked believable."

Animators also maintained verisimilitude in Aslan's body animation, executing only movements found in the live lion reference. At one point, the filmmakers had considered motion capturing a lion as the basis for gross body animation, an idea that was particularly appealing to R&H motion capture supervisor Patrick Runyon, who had worked previously as a tiger trainer. But scheduling conflicts – and a reluctance to attempt affixing targeting markers to a lion – thwarted the plan. "Our animators had done such an incredible job with the walk cycles and such," Westenhofer stated, "motion capture wasn't necessary anyway. Keyframe animators worked side by side with our actual lion reference, so it was a type of motion capture – it was just the animator's eye that was capturing it!"

Lion reference also drove the look of Aslan's fur, which was made up of 20 different pelt groups, each of which varied in thickness, curl and texture. Creating a truly photorealistic fur, with all of its richness and variation, was such a complex, labor-intensive feat, R&H spent a year building up Aslan's mane alone. "It took an enormous amount of time just to get the hair to look right in a still frame," Westenhofer commented. "And then, of course, we had to get it to move properly." That task fell to the technical animation department, which developed a guide-hair collision detection system to simulate broad intersections of fur across the body. "It was still computationally impractical to do a full collision detection between every hair; so, instead, we had artists use combing controls to 'groom' the hair and make it look right, almost on a frame-by-frame basis. Then we used true dynamics to get wind to blow through it, making it curl and intersect with the body. On top of those dynamics, we had 'pelt wind,' which acted differently on specific pelts and gave us the ability to subtly move individual hairs, like the fine wispy hairs at the edge of the face. That was great for the closeups, where we wanted to suggest a really faint breeze blowing across his face."

Such meticulous attention to detail resulted in a truly compelling computer generated Aslan, arguably the film's most significant character. "I've never been on a project where an animated character carries as much of the weight of a movie as Aslan does on this one," Richie Baneham noted. "I've also never been on a project where an animated character has been so well received by the director – or so well respected. Andrew always treated Aslan like any other actor. The fact that it was a CG character didn't bother him one iota. He just wanted a performance that best served the movie."



KNB artist Sarah Graham at work on a hero satyr makeup application, one of two featured in the movie. Produced on a fairly tight schedule, KNB's practical creature tally reached some 170 characters, many with complex mechanical requirements. A few were created and used primarily as lighting stand-ins for digital characters that would be added during post production.

In addition to Aslan, R&H was assigned the film's epic final battle, which would feature 40 unique computer animated species, fighting in armies of 5,000 on Aslan's side and 15,000 on the White Witch's side. Production had engaged a lidar vendor to survey the entire Flock Hill location where the final battle was shot, providing R&H with down-to-the-inch representations of the huge battlefield, which would be crucial to tracking partial or all-CG characters into the plates. "Initially," explained Westenhofer, "there were a lot of plates with all these upper-half characters and a trillion green legs running around. But as the schedule wore on, and weather in New Zealand continued to be a challenge, we wound up shooting more empty plates, simply because it was less time-consuming. That meant we ended up having to do full 3D characters, rather than just track CG lower halves to live performers. We'd get a completely clean plate – or maybe just a shot of Peter running around with a unicorn – and we'd add everything else."

To better integrate its computer animated elements with the live-action plates, R&H spent a year prelighting the 60-some varieties of creatures featured in the final battle. "We had many different artists working on these characters," Westenhofer observed, "and they didn't all set up the lighting the same way – which meant that there could be a lot of variation from one creature to another. To avoid that, we set up this prelighting within three different worlds: the daytime battle, a night scene and a snow scene, which were the three general environments we'd see the creatures in. We paraded the models through each one and looked at them side by side to make sure the lighting worked on all the different creatures."

During principal photography, the visual effects crew had taken pains to capture location lighting information at Flock Hill, using a custom-built cube housing six digital cameras. "We could put that cube down on set," explained Westenhofer, "and it would march through a bunch of different exposure settings in about 20 seconds, giving us the full 360-degree high dynamic range exposure to light the scene. With only a set of lights and this environment map, we were able to get very realistic lighting that fit pretty much right off the bat. With all the prelighting and this HDRI, the first pass of our renders looked great. The time spent after that was just sweetening them and integrating them into the plates, rather than struggling to make them look realistic to begin with."

Centaurs would be prominent characters in the final battle. Judged a 'pain in the rear-end' by the practical effects crew, the creatures proved no less challenging in the digital realm. R&H took three approaches to the centaurs: creating all-CG versions, tracking CG horse bodies to live performers, and marrying CG human upper bodies to real horses shot on location. "We'd filmed real horses wearing blue neck-warmers that we used as a matte line around their necks," said Westenhofer. "We did that for shots where the centaurs were running or doing things like leaping over camera. We filmed the horses with riders on them, scrunching up their legs as much as they could so they wouldn't show too much on the horse body, then replaced the horse's head and neck with a CG upper human."

Minotaurs were also integral to the final battle. Though KNB had provided practical minotaur suits and heads for closer shots, R&H tracked in CG minotaur legs to create the appropriate reverse-knee look in full-body views, and also animated all-CG minotaurs for more dynamic battle action. "The stunt guys and extras could only do limited physical action wearing a 60-pound suit and a big animatronic head," Richie Baneham explained. "In our animation, we couldn't break away too far

from what they had shot with the suits – we still had to retain that feeling of weight and mass – but our CG minotaur could do physical stuff that couldn't be done in the live-action.”

Another featured character in the battle was not even on the slate when production started. Initially, the storyboards had illustrated a hawk bringing the message to Peter that initiates the battle; but footage obtained with a rather scrawny real hawk was not spectacular. Back in Los Angeles, R&H animators, led by Michael Holzl, had been developing a griffin – a half-eagle/half-lion creature – intended to be seen flying in shot backgrounds. “It was just going to be this secondary character that you saw in the air,” Westenhofer noted, “but the motion study of this griffin landing was very impressive. So we showed it to Andrew, and right then and there he scrapped the hawk idea, and the griffin became a major speaking role.”

Sony Pictures Imageworks, headed by visual effects supervisor Jim Berney and digital effects supervisor David Smith, created a total of 562 shots, among them 25 shots for a two-minute ‘bombing of London’ sequence that opens the movie and sets up the children’s evacuation from the city. “Andrew really wanted to set the movie in the real world before it went off into the fantasyland of Narnia,” Dean Wright explained. “This very real bombing sequence was a way to do that.”

During principal photography, Berney and a small splinter unit had gone to London to shoot textures for CG houses that would make up the children’s neighborhood, as well as textures for a CG train station and reference photos for CG bombers. SPI also composited greenscreen photography of performers in gimbaled cockpit mockups, shot by Rpin Suwannath, into the sequence, as well as shots of the children running out of their house as the bombs drop.

A more significant percentage of Imageworks’ overall shot load would involve the beavers who lead the children to Aslan. Imageworks first modeled Mr. Beaver from a scan of the Weta maquette, which was a full-body sculpture, complete with muscles and the suggestion of a skeletal understructure. “One of the first hurdles with the beaver model,” remarked Imageworks animation director David Schaub, “was pulling out some of the muscles that had been presculpted in the maquette. It was better to build a bag of fat and reproduce the sculpted muscles procedurally rather than to try and work around muscles that were already sculpted in.”

As he had for Aslan, Adamson wanted absolute naturalism in the beaver’s appearance and behavior. However, whereas Aslan was never required to display behavior beyond what a real lion would do – other than speaking – Mr. Beaver would start out very beaver-like in his demeanor, then move into more human behaviors, such as walking upright with a mug of ale in his hand. “The biggest challenge with the beaver was just getting that transition from naturalistic beaver to a more anthropomorphic character,” Schaub observed. “Typically, for a creature like this in the CG world, you would build a quadruped beaver and a separate biped beaver – two distinctly different models and rigs that would be interchanged as needed shot to shot. But in this case, we had to go from a quad beaver to a biped beaver in the same body, and in the same shot.”



Astride a white unicorn, Peter (William Moseley) prepares for battle, flanked by a battalion of centaurs. Rhythm & Hues used Massive – the crowd simulation program first developed for *The Lord of the Rings* – to create vast multi-species armies for the final battle. Rhythm & Hues conducted a comprehensive six-month-long motion capture project to generate animation for the centaurs and other creatures that would be created in Massive. Motion capture performers re-created centaur upper-body movement that had been defined in choreography sessions in New Zealand.



Mid and foreground centaurs were filmed on location in New Zealand, portrayed by actors in Weta Workshop armor and green-colored tights, creating a matte area for background restoration and the tracking of digital horse bodies. Centaur actors stood on 14-inch-tall platforms to elevate them to the appropriate heights. Featured centaurs were motion captured on set by Giant Studios, generating data that aided R&H in locking CG horses to the live-action performers. Realistic horse animation was derived from the motion capture of real horses on location and at an equestrian center in Los Angeles.

Basic beaver walk cycles had been developed very early, but more performance-oriented animation was initiated only when Ray Winstone and Dawn French had been cast as the voices of Mr. and Mrs. Beaver – though video of the actors delivering their lines served only as the most general guide. “We didn’t really use that video much,” Jim Berney remarked, “because Andrew wanted us to find our own Mr. and Mrs. Beaver. We spent about four months just experimenting and discovering who these characters were.”

Rather than plug in pre-modeled phonemes, animators hand-animated muzzle movement for shots of the beavers talking, employing the proprietary facial muscle system Imageworks had developed for the keyframed human characters in *The Polar Express*. “We built that muscle system into the beaver’s face,” said Schaub, “laying out the muscles the way they would be in a human face, so the mouth would move in ways that would accommodate the lip-sync. It is an elaborate muscle system, so we were able to get a lot of different shapes. These muscles became our sculpting tools, and were manipulated to create pre-defined poses that our animators could access easily. But we weren’t just hitting poses. There were a lot of overlapping things going on in the face. We’d pull the corner of the mouth back, and the cheek volume would bunch up – but with staggered timing, so that it felt very organic and natural.”

Imageworks applied that same lip-sync approach to its talking CG fox, rigging it with the facial muscle system, somewhat altered to make it work with the character’s facial structure. “This was the first time we’d tried to use it on an animal with a long muzzle,” Schaub explained. “Once we’d adapted it, we went through the same process of building poses for all the fox lip-sync.”

A considerable amount of secondary animation was required to keep the fox character alive. “There was a lot going on beneath the surface of the skin,” said Schaub, “such as the scapulas pushing up when weight was put on the paws. We’d seen from our fox reference footage that there was always something moving. Even when the animal was standing still, breathing, you could see the muscle contractions in the belly, the expansion and contraction of the chest, and air being pushed through the windpipe. All of that secondary animation was rigged for an animator to do by hand. On top of that, there was a dynamics simulation for the fur that was dialed in for general movement. We’d do the animation, then the secondary work – the jiggle and other stuff that would be hidden by the fur – and then, once we ran the fur, we’d go back for another round and amp up the jiggle a little, to make it read with the fur. Finally, we’d go in for a fur dynamics pass, just to sweeten it.”



Production employed a variety of rigs on location to create the suggestion of a horse’s gait in the human upper-body centaur performances. At Flock Hill, where the final battle was staged, crew members manipulate a centaur performer mounted to a rocking dolly rig. In post, Rhythm & Hues replaced the rig with the animated horse body. The effects company likewise tracked minotaur legs to the centaur’s adversary, using red markers affixed to the performer’s green tights. In select minotaur shots, Rhythm & Hues tracked computer animated heads to live-action performers.

The sophistication of Imageworks' fur package enabled the team to exactly match CG wolves to the wolf/dog hybrids that had been shot on location – a critical issue, since the CG and real wolves would often share the same frame. Despite production's early hopes to get all of the non-speaking wolf shots with real animals, CG wolves sometimes were required even in shots in which the characters were silent. "The main problem with the real wolves," remarked Dean Wright, "was that they looked too happy. They'd be standing there with their tails wagging – and they were supposed to be scary! When they were running, they looked great, and we got a lot of nice shots of that; but whenever we settled on them, we could only get bits and pieces. Another problem was having them work with the kids. The first day we had the dogs on set, we showed them the fur coats the kids would be wearing, just to acclimate them – and one of them went after the fur coats, snarling and growling. So that was that. 'No wolves on the set with the kids, ever!' That meant that we had to do CG wolves whenever there was a big scene with the kids." In scenes not featuring the children, in which the real wolves could be used, key placement of even one CG wolf in their midst could transform a so-so shot into a great one. "That one CG wolf could be animated to do something to suggest intelligence, for example, and it wouldn't matter that the other real wolves were just standing there. By adding in that one smart wolf, you bought that all the wolves were thinking and smart."



When the shot count rose dramatically in post production, Industrial Light & Magic took on parts of the assignment. Among ILM's shots were those featuring the dryads, beautiful creatures made of floating petals and leaves that greet visitors to Aslan's camp. Though production shot actresses on a greenscreen stage to capture facial images, dryad bodies were comprised entirely of computer animated foliage. ILM referenced photographs of real blossoms and leaves, then employed particles imulations to create the dryads, subtly dialing in the greenscreen faces of the live actresses.

Digital wolf models were built from measurements and photographic reference of the live-action wolves, and were animated to match the real animals' behavior. "Since we were matching those real animals," said Schaub, "we couldn't depart too much from them in the animation. Even when the wolves talked, we made sure to keep the muzzle movements to those a real wolf could execute."

Unlike Rhythm & Hues' computer generated characters, most of which were composited into New Zealand location plates, nearly all of Imageworks' sequences had been filmed on partial sets surrounded by greenscreen, and thus required synthetic environments and set extensions. One such shot was a 360-degree view of Narnia, revealed from the top of a hill the children have climbed in search of Edmund. "They had shot the kids on a snowy hill," related Berney, "with a few trees here and there, but there was greenscreen all around them; and so we had to create that entire vista for about 30 shots. Almost anytime there were big vistas of the winter scenes, we created those environments, using photography from the Czech Republic or Poland. We added CG trees on cards, and also added a lot of CG snow."

Another synthetic environment extended a set representing part of the White Witch's castle courtyard, where Edmund finds creatures that have been turned to stone. "They had parts of the statues on the set," said Berney, "but whenever they shot up off of that set, we had to extend it. When Edmund enters the castle, the first shot of that interior was all CG, except for the actor. We also had 30 shots in the throne room, where all they had on set was a floor, some columns and a throne. All around that was green, and we filled that in with a 3D model of an icy throne room. The main problem with an icy room is that it is difficult to create a sense of scale. We were trying to get the look of a vast room going off into the distance; but it was difficult to sell the size in a place where everything was shiny and reflecting on itself. We got around that through lighting, mainly, and by putting in some scale clues, such as a door in the very back of the room."



Among the animatronic Aslan puppets built by KNB was a head-to-tail riding version, filmed on a greenscreen stage for scenes of Susan (Anna Popplewell) and Lucy astride the reborn lion. The riding puppet was capable of full head rotation, plus eye, tongue and lip movement, as well as a rocking motion to suggest the lion's gait. Forward movement was obtained by mounting the puppet to a track.

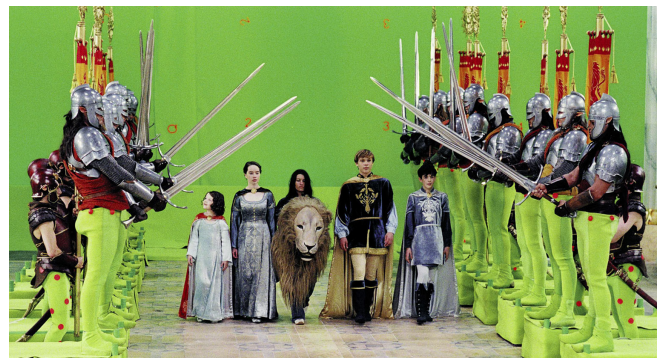


In final shots, Rhythm & Hues extracted the riding movements of the girls from the greenscreen footage, replaced the puppet with the CG Aslan, and surrounded the characters with location plate photography.

A sequence in which the children and Mr. and Mrs. Beaver, chased by the wolves, attempt to cross a river at a frozen waterfall was a combination of a live-action set, Imageworks extensions, and miniatures. “As they cross,” Berney explained, “the waterfall collapses, and they are rushed downstream. In New Zealand, we shot a set that had a section of the frozen waterfall, as well as ice floes that were gimbaled around. We also shot a dump tank in the Czech Republic, so that we could create this wave of water that engulfs the characters and pulls them down the river.”

New Deal Studios built and shot two miniatures for the scene, one a 1/12-scale model of the frozen waterfall and adjacent riverbanks, and the other a quarter-scale section of waterfall rigged to collapse and fall. To match the models to the partial full-scale waterfall set, New Deal visual effects supervisor Ian Hunter referenced conceptual art and set drawings provided by the art department. “Based on that,” Hunter said, “Scott Schneider built a 3D model of the waterfall in the computer. We lined that up to the concept art with a virtual camera, trying to get the model to match as closely as possible. Once we got a buy-off on that 3D version, we went into construction, using the 3D model to generate plans and elevations.” New Deal also provided Imageworks with the computer model, allowing the digital artists there to track their animated wolves and beavers to it, ensuring that they lined up with the final miniature photography.

Forest Fischer supervised construction of the 1/12-scale model. Styrofoam sections were cut to the contours generated from the 3D model and stacked in rows to create the shoreline on either side of the river. “To create rocks and ice,” Hunter said, “we sculpted some rock faces, molded them, cast them in foam, and applied them to the styrofoam under-surface so that we could get a lot of detail without having to hand-carve each rock. We did a similar thing for the ice, sculpting rows of icicles in various lengths, and sheets of ice that were about the size of a blotter, then molding and casting those in clear resin and applying them to the face of the waterfall.” Because the same model would be featured in both winter and spring scenes, the icy face of the waterfall had to be detachable. “We covered the whole face with a sheet of plastic that we heat-formed to match the contours of the waterfall and applied all of our ice dressing to that. That whole face could be unscrewed and removed when we had to go from winter to spring.” The main section of the 1/12-scale miniature measured 12 feet wide and 24 feet long, with an additional 32 feet of riverbank extending out from there. Banks were lined with hundreds of miniature trees.



Although the film was shot primarily at location exteriors, interiors – such as the castle that is the setting for the coronations of Lucy, Susan, Edmund and Peter as queens and kings of Narnia – were most often photographed on minimal sets built on soundstages throughout New Zealand. The plate for the coronation sequence was

comprised of only the actors, an Aslan stand-in, and platform-elevated centaur performers on a section of synthetic throne room environment that included a digital castle floor, hacked by greenscreen. ILM also tracked horse bodies to the centaur performers, composited in additional rows of spectators, and incorporated Rhythm & Hues' computer animated Aslan into the scene. A latecomer to the production, ILM had to complete its slate of 211 animated shots in only ten weeks.

The miniature was shot motion control at New Deal, by director of photography Tim Angulo, using motion control moves derived from Imageworks' post tracking of the live-action. "We used our motion control camera with a snorkel attached to it so we could get the camera low over the ice and simulate the low angles they had on the live-action," Hunter explained. "The remaining shots were either very simple pans or lock-offs that we could do just by finding the correct angle and matchmoving." The miniature was shot against greenscreen, and later surrounded by Imageworks' matte-painted and photographic environments.

The quarter-scale miniature, employed for shots of the waterfall collapsing, was built in New Deal's parking lot, suspended over a 16-by-24-foot tank filled with four feet of water. "The tank had a weir at one end," said Hunter, "and a series of irrigation pumps that allowed the water to flow out into a catch tank, then be recirculated back to the top of the waterfall. So the waterfall was in constant motion during the shooting. In the movie, even though the waterfall is frozen over, there is still water running behind it; and when it collapses, we see that moving water." The same effect of running water behind the ice would be created digitally in the 1/12-scale model, composited into translucent areas New Deal had fashioned just for that purpose.

The face of the waterfall miniature measured 14 feet tall and 10 feet wide. "We molded a rock pattern," explained Hunter, "made a fiberglass rock face, and mounted it on a steel frame. In front of that we had about 90 resin ice pieces that fit together in a puzzle pattern to form the base of the waterfall in its frozen state. Those were all suspended on steel rods that went from the back of the rock wall into the ice piece; and then we had big pneumatic rams that would retract the pins and allow the ice pieces to fall. On top of that we had a dump tank with a door on it. We'd drop the door, the water would come rushing forward, we'd trigger the pneumatics, and all the ice would fall."

Industrial Light & Magic did not join the Narnia team until well into postproduction, leaving visual effects supervisor Scott Farrar, animation supervisor Jenn Emberly and their digital crews only ten weeks in which to complete 211 shots. What had initially brought ILM onto the project was the unforeseen abundance of CG leg replacements required for the fauns, centaurs and other animal-limbed characters – a task that grew too big for Imageworks or Rhythm & Hues to handle alone. As it did for those vendors, the process involved tracking CG animated and rendered lower halves to the torsos of live performers. "After a first pass," recalled Farrar, "it would look completely haywire; and so we'd have to keep correcting and tweaking it until it looked right. Lighting was a big issue, as well, because most of the plates were exteriors. We had overcast skies and bright sun skies and left-lit and right-lit – every possible variation of lighting. The curly, tufted hair on the legs of the fauns

was especially hard to light so that it looked good, whereas the horse hair on the centaurs had a sheen to it, and was a little easier to light.”

Occasionally, the action performed by the human performer in the plates was not appropriate, and ILM would animate not just the lower half of the creature but the upper half, as well. “We would change what the actor did, just to make it look more interesting,” said Farrar. “In other cases, what the guys had done just didn’t work once you got the animal legs on them. For example, there was a shot in a scene at Aslan’s camp where the fauns had to kneel – but if the performers got too low to the ground, it was lower than the faun bones could really bend. So we had to do some cheats and readjust the faun legs to make that work.”

One of ILM’s biggest challenges, with regard to the centaur shots in particular, was blending different-sized human torsos with a one-size-fits-all horse body. “None of the centaur performers were exactly the same height or size,” noted Farrar, “and yet we had one CG horse body of one specific size. So if we scaled him up to make him work with the taller guy, the horse would look taller, but he would also look fatter; and if we scaled him down, he would get shorter, but too thin. We had enormous problems making sure that the waist of the human was the right size to join as it should, but still have an appropriate-looking animal underneath.” To solve the problem, ILM created an independent CG midriff join section that could be resculpted with shapes, as needed, depending on the size and proportions of the performer being tracked.

In addition to replacing the greenscreen area of the performer with the animated horse, ILM had to restore backgrounds occluded by the 14-inch platforms on which the centaur actors had performed to enhance their height. “We had to remove the platform and the skirt around the platform,” said Farrar, “so there was a ton of background stuff missing that we had to put back in. Fortunately, Dean Wright and the gang were usually pretty good about shooting clean plates so we could restore all of that.”

ILM also filled under-populated live-action scenes with all-CG characters. For both the leg replacements and the all-CG characters, ILM most often worked with models obtained from Rhythm & Hues, then converted those to its custom pipeline. “We came in so late,” stated Farrar, “we really had to work with R&H’s models. And once we put those models into our shots, we still had to do a lot of work – animation and fur changes – to integrate them into our shots.”

Fifty of ILM’s shots are featured at the end of the epic battle, after R&H’s Massive armies have clashed. “Our shots start once they get to hand-to-hand combat,” said Farrar. “In most cases, we had plates with maybe two to six actors in them, and we had to put in 16, 20, 40 different creatures fighting amongst those live actors, all hand-animated. It was a very big job to plus all of that out and make it look as if there was all this mayhem going on around the live-action people.” Emberly and her animators were allowed a great deal of creative freedom in choreographing and inventing the fight action. “Often, animators have to work in a rather restrictive manner, animating specific action that has already been worked out. But on this, they were able to orchestrate what kind of skirmish it was going to be, deciding this minotaur would take down this creature, for example, and how. Then, of course, we’d run it by Andrew, who would suggest things to improve the animation.”

Embellishing and augmenting sparse live-action plates often required generating entire synthetic environments, as well as CG characters. For the coronation of Peter, Edmund, Susan and Lucy as

Kings and Queens of Narnia at Cair Paravel, ILM was given a greenscreen plate that had only a short row of spectators, four thrones, a background wall and two pillars. “From this pip-squeak amount of greenscreen,” Farrar commented, “we made this huge scene – crowds of creatures and people within a whole environment. We added several rows of people and characters and animals, extended the front row two or three times in length, put in the palace behind them, and, behind that, the entire background and sky.”

ILM also created a view from Cair Paravel for a scene in which Lucy and Mr. Tumnus talk on a palace balcony. “We had Lucy and Tumnus in the foreground,” stated Farrar, “with this whole beach view beyond them, going out to the horizon. We kluged that view together from plates the production had shot in New Zealand. We did the same kind of crowd and set extension for scenes in Aslan’s camp. There was supposed to be a huge crowd of creatures and characters there, as well as a lot of tents. On location, they had shot only a few tents and a few performers; and so we augmented that with 3D tents and characters. Our digimatte artists also created the background landscape.”

In addition to animating and integrating the R&H models into plates and their synthetic environments, ILM produced a number of custom characters, such as the dryads, beautiful female creatures made of apple blossoms and willow leaves, who greet the children when they first enter Aslan’s camp. Production had photographed two actresses in makeup to portray the dryads, both on the greenscreen stage and on location. “They’re in female form,” explained Dean Wright, “and you can discern a bit of their faces, but their bodies are made up of constantly moving petals and leaves, all CG and all animated.” Referencing photographs of real blossoms and leaves, ILM employed particle simulations to create the animated petal- and leaf-creatures, subtly dialing in the greenscreen faces of the actresses.

ILM also created custom ‘fire creatures’ for an early scene in which Lucy visits Mr. Tumnus’ home and spots whimsical characters dancing in the fireplace. “We took an assortment of creatures, such as a bear and some satyrs, and animated them in a circle,” explained Farrar. “Then we went into Sabre, our 2D suite, and put them into the fire in the plate – walking a fine line so you would barely be able to detect them. It was an esoteric challenge to get them to read clearly to the viewer, but yet not be too over the top. We didn’t want it to look like cartoon characters running around in the fire.”

All three vendors delivered the last of their effects shots for *The Lion, the Witch and the Wardrobe* at the end of October, six weeks prior to the film’s December 9 release. With literally half of the screen time devoted to computer generated characters, the movie, in its final form, was as much an animated feature as it was a live-action one – making it, for Andrew Adamson, both a return to familiar territory and a venture into the unknown. “The experience of doing this movie and the experience of doing the Shrek animated movies felt very similar,” Adamson said. “The processes involved in animation and live-action are a bit different, but the challenges are basically the same. I’ve described it before as the difference between a marathon and a sprint. Live-action is like a sprint – more intense, but short – whereas animation is longer and less intense, like a marathon. Of course, in this case, it was both intense and long! This was definitely the most complex, difficult movie I’ve ever been involved with – and the most complex and difficult I ever hope to be involved with. My next movie, I want to direct the sequel to *My Dinner With Andre* – two guys sitting in a room, talking.”

"Nothing is set in stone," Wright remarked, "but I'm hoping to be part of the next movie. As hard as this one was, it was also exhilarating. I remember a moment standing in New Zealand, with the beautiful mountains all around us, and all I could think was: 'Where else would I rather be right now? I'm exactly where I want to be.'"

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